JUNE 10, 1957

the OIL AND GAS JOURNAL

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will operate to produce 64,000 tons per year . . . p.82

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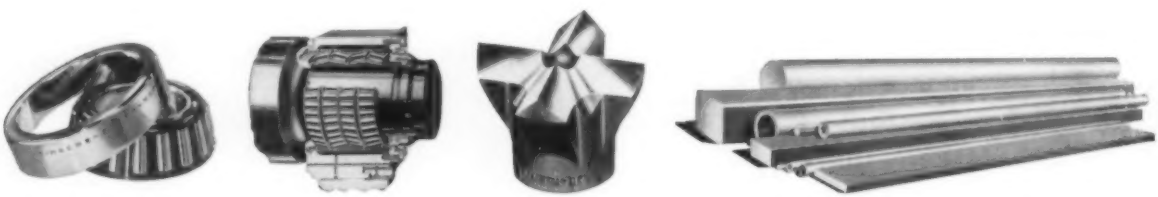

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JOURNAL News Letter

June 10, 1957
Tulsa, Okla.

Independents are demanding the oil industry peg prices to costs:

Robert L. Wood, I.P.A.A. president, is making a case for a 4-cent a barrel price increase for crude to cover the 6 per cent wage increases being given throughout the industry. He says cost of the wage hike is $100 million a year.

Here are Wood's figures: About 325,000 employes in oil and gas production draw $1.7 billion yearly in wages. The 6 per cent increase in the payroll hits about $100 million or 3.75 cents per barrel based on present domestic production of 2.7 billion barrels yearly.

Wood's argument: Costs of producing oil cannot continue to go up while prices remain unchanged. The oil industry tried that for 3-1/2 years and it didn't work. Present crude prices are inadequate and force the industry to sell its products below replacement costs. That's one explanation for the current slump in exploration and drilling in this country.

BIG MONEY: Oil will have to invest $60 billion within the next 5 years to keep abreast of growing world demand. That's the prediction of Texaco Chairman Augustus C. Long. This puts expenditures for the period at nearly double the rate for the last 10 years. Half of the spending will be abroad.

The picture ahead: Domestic demand will hit 12.1 million barrels daily by 1965, nearly 40 per cent above present levels. Free-world demand outside the U.S. will reach 14.6 million barrels daily, almost 115 per cent above today. The booming demand will be met by stepped-up Middle East production.

WASHINGTON: A 15-month Senate probe into oil lobbying has wound up with only two results: Internal Revenue ruled contributions to the fight for the Harris-Fulbright bill are not deductible, and a stiffer lobbying bill is being written for consideration by Congress.

Concentration of America's oil industry in a few areas has defense officials worried. The defense experts say 49 per cent of vital oil industry is herded into 18 areas, nearly 58 per cent is in 36 areas, and 62 per cent is in 57 areas. A single atom bomb could wipe out any one of these areas. Most of these areas involve refineries or petrochemical plants. Fortunately oil fields

and pipelines are much safer.

LOOK BACK: Oldtimers in the oil business had a touch of nostalgia last week. Ernest O. Thompson observed the 25th anniversary of joining the Texas Railroad Commission. The occasion recalled boisterous days when Thompson tamed rampant East Texas field a few weeks after going on the commission. Since then he has played a vital role in some of the biggest technical, legal, and administrative strides ever made by the industry.

LOOK AHEAD: Expect the big Oil, Chemical, and Atomic Workers Union to step up its drive to entice independent oil unions into the fold. O.C.A.W. got a 6 per cent wage increase for its members while some of the independents settled for 4 and 5 per cent boosts.

Oil producers in the Dollar Bay and Moses Lake areas near Texas City can expect a tax increase. The Texas Supreme Court has upheld Texas City's right to annex the submerged lands. This gives the city the right to tax oil production.

In California, the city of Santa Barbara also annexed some possible submerged oil lands. The reason was different: Citizens there wanted to keep oil development away from their expensive homes and beaches. The city took in a wide area 3 miles from shore and several miles along the beach.

EXPLORATION: One of the largest gassers ever along the Eastern Shelf in West Texas has been brought in by Jocelyn-Vern Oil Co. Its 1 Stella Lloyd in Allison field of northern Sutton County got big flows from two zones. In field's regular Lower Canyon flow was 35,000 M.c.f. daily at 3,750-810 ft. In a Pennsylvanian reef at 4,593-648 ft. flow was 120,000 M.c.f. daily.

An early upswing in oil activity in Bolivia is in prospect. This was underscored by three developments last week: Bolivia asked U.S. companies to bid on a 108,200-acre concession near Argentine border... Glenn McCarthy was selling his Bolivian interests to a new combine... Bolivian Gulf says it has shipped a heavy-duty rig to drill first test on its 3,750,000-acre concession.

Venezuelan Atlantic Refining has logged 690 ft. of prospective oil sands in a test 3-1/2 miles northwest of Santa Barbara field in Monagas. Such a thick pay zone is unusual for eastern Venezuela.

Two recent strikes in the enormous Powder River basin of Wyoming and Montana are arousing new interest in the second largest basin in the U.S. True Oil Co.'s discovery on the basin's east side is being followed by a promising well right in the center of the basin. Operator is Farmers Union Central Exchange (P. 171).

Oklahoma operators have marked up some significant discoveries during the first half of 1957. These promise the state a sharp increase in both development and exploration the rest of the year. Areas to watch now: Southern Oklahoma's deep Ordovician play, rapidly expanding new Cherokee-Penn play in Alfalfa County, the southeast Stockholm-Pennsylvanian gas-distillate and oil development in Harper County, and the Morrow-Penn trend shaping up in Woodward County.

Other Texas operators will be affected by an appeals court victory won by The Texas Railroad Commission over Sun Oil. At issue were freight rates for hauling casing and drill pipe. Sun originally had pipe shipped from Pennsylvania to Houston by barge. There it was unloaded and taken to storage yards of a motor carrier. Later it was shipped to specific points on Sun's orders. The company held the entire shipment was interstate. But the court ruled the shipment was broken at Houston and that higher intrastate rates should apply on the journey from Houston to the oil fields.

DRILLING: Gulf is making a new percussion drill available to the industry. Researchers claim the hammer tool may be one of the most significant developments for drilling in recent years. Tests with the drill achieved greater penetration rates, longer bit life, and straighter holes in hard formations than conventional rotary drills. Device uses drilling mud to power a mud engine and deliver blows to a regular rock bit.

Glasscock Drilling's $6.5 million Mr. Gus II is going to work this month for the C.A.T.C. group on a multiple-well drilling program off the Louisiana coast. The mobile platform is the most expensive drilling vessel yet built.

PRODUCTION: Full-scale water flood will start by July 1 in Adena field, the first ever unitized under Colorado's conservation commission. Five producing wells have been converted to injection, 22 more input wells drilled and ready for hooking up. Water-supply lines are in, and the injection plant is nearly ready. The flood is expected to add 30 million barrels to field recovery. Meanwhile, the target date is September for unitizing Colorado's biggest field, Rangely. This project has been in the mill for nearly 10 years.

Aramco for the first time is planning to use Arab contractors for a major construction job. Company expects work to start this summer on a new 250,000-M.c.f. gas-injection plant. It will use the latest turbine-type compressors and a television closed-circuit control system.

Cheaper tanker rates are playing hob with Alberta's June production. Allowables have been set 16,981 bbl. daily below May. The drop in demand is blamed on new tanker rates which allow oil to move economically from Southeast Asia and Middle East into California refining areas.

REFINING: The anticipated boom in asphalt sales is not shaping up. Factors behind the soft market: Delays in getting federal highway program started and the decline in home construction. Highway building and maintenance account for 71 per cent and roofing 21 per cent of asphalt markets.

Gulf Oil may become first major refiner to adapt hydroisomerization to its refinery program for making very-high-octane motor fuels. Company plans to build a pentane isomerization unit soon, probably on the Gulf Coast.

Battle is shaping up over gasoline markets in Canada. British Petroleum and Cities Service are following Canadian Petrofina into the country with new plants. Established companies also are expanding from coast to coast. Price wars already are breaking out in isolated spots.

Synthetic ammonia is getting a price boost, primarily on the basis of improved rainfall in many sections of the U.S. Extended drought in the Southwest

had hurt the market. This doesn't mean that the period of excess capacity over demand is ending, though. Ammonia capacity is now 4,130,000 tons, about 123 per cent of estimated demand.

The gas turbine now is ready for application in heavy trucks and military vehicles. Further use also is anticipated in heavy off-the-road equipment, stationary power plants, and marine propulsion. In a recent progress report, General Motors significantly made no claims for the gas turbine in passenger cars.

The sight of vapor-locked motorists lined up at the head of traffic jams may become more commonplace as air-conditioned cars come on the road in bigger numbers. Humble, which is in the middle of the air-conditioned car belt, reports last year's models showed no improvement in volatility limits over 1955 models. Every motor-car maker puts out at least one car which handles the situation well. Refiners hope this will spread. They want to stop a trend toward less blending of butane and higher fuel-manufacturing costs.

PIPELINING: Onstream pigging is paying off for Texas Eastern Transmission. The big pipeliner is operating at an efficiency of 96 per cent, 4 per cent above the accepted average. Each additional 1 per cent of efficiency means Texas Eastern can sell 15 million cubic feet more gas daily.

Shamrock Oil & Gas has sharply reduced its gas-drilling program. The reason is similar to the one given recently by Panhandle Eastern when it took the same action: Uncertainty over federal pricing and lack of incentive.

Pacific Northwest Pipeline expects to connect more than 400 new wells this year to its gas line from San Juan to the Canadian border. In addition the pipeline will begin receiving Canadian gas from Westcoast Transmission November 1.

The industry's tax bill goes up in Kansas next month. The 1 per cent severance tax on natural gas goes into effect July 1.

RESEARCH: Phillips Petroleum has a research policy that has kept the company in second place for several years in number of patents issued. Here's the pattern that has made Phillips research payoff: Make research a part of company growth...Build up a technical group on formula of brains, imagination, curiosity, and teamwork...Keep these scientists close to company operations, not in an ivory tower...Keep a share of technical people working on the unknown, watching for things that can be profitably linked to Phillips business.

Nuclear research is becoming a conventional adjunct to petroleum labs. In the next year, Texaco will complete a new nuclear research center at Beacon, N. Y. It will boast 6-million-volt linear accelerator, first in the oil industry, a 3-million-volt Van de Graaff, and a 35,000-curie cobalt-60 source of gamma rays

Radioactive tracers are giving added evidence that the heavy ends of gasoline are the culprits in engine-deposit formation. Esso Research reports that certain high boiling aromatics are the worst offenders, followed by heavy olefins and long-chain paraffins. Deleting these high-boiling materials from gasoline will in effect raise octanes by reducing the requirement buildup in new cars.

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TECHNOLOGY–OPERATION

Refining-Processing

First Postwar Butadiene Plant Now on Stream **82**

By W. J. Brack and M. R. Beychok

This plant, owned and operated by Texas Butadiene & Chemical Corp., of Houston, is the first privately financed butadiene plant in the nation. The $30,000,000 plant starts with normal butane and isobutane to produce 64,800 tons per year of butadiene and about 2½ million barrels of high-octane gasoline.

On The Job . . . In The Plants **100**

Truck-loading rack fights fire hazards ($150,000 installation at Shell's Wilmington refinery includes several new ideas on safety). Bay refinery meets water crisis at time of low river level.

Isomerization of Pentane and Hexane **119**

By Henry G. McGrath

The vapor-phase Iso-Kel process operates under hydrogen pressure and requires but one reactor. A pentane-hexane feed can be isomerized simultaneously with no harmful interaction. Each stock appears to contribute to the isomer production in the same manner as when separately processed. Pentane conversion is about 65 per cent per pass while hexane conversion is about 75 per cent per pass.

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Drilling-Production

Field Processing—35: Principles of Gas Flow **94**

By Dr. John M. Campbell

The fundamental thermodynamic equations used for liquid flow may also be used for gases. Bernolli's theorem is a logical starting point for deriving appropriate equations. Several flow equations for field work are developed.

Water Poses Tough Problem in Drilling With Air **105**

By A. S. Murray and S. P. MacKay

Here are important results from Imperial Oil's air-drilling tests in western Canada. The drilling fluid ranged from air to aerated water. Water influx of 100 bbl. per hour was found to be the maximum for economic air drilling. With foam injection, drilling proceeded with water influx of 500 bbl. per hour. However, penetration rate when air lifting 500 bbl. per hour was no greater than the rate when drilling with mud.

Pipelining

Pipelining Crude with 110° F. Pour Point **89**

By J. M. Rupert and B. N. van Diemen de Jel

This crude will be pumped through a 94-mile 8-in. crude-oil pipeline from Lirik field in Central Sumatra to a deep-water terminal on Siak River, near Buatan. The right-of-way traverses hilly jungle country and about 12 miles of swamp. Five pump stations and a loading terminal are to be completed by the end of 1957 for the project.

Pipeline Patrol: Construction Report **135**

General

Better Management: Some Tips on Planning **129**

The oil industry continues to demand more and more from the men placed in all phases of supervision. And planning is one of the many important tools of the management function. This Journal foldout report is divided into three parts: Plan development, plan initiation, and plan charting.

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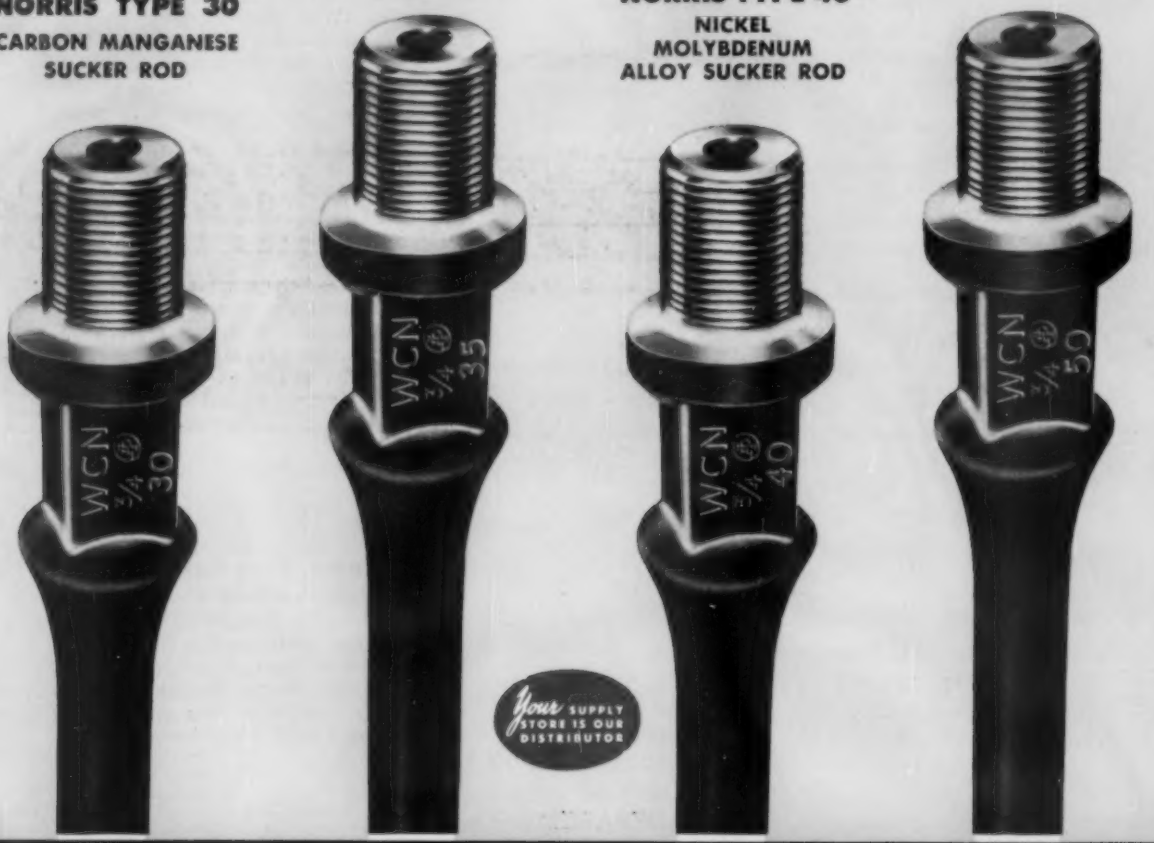

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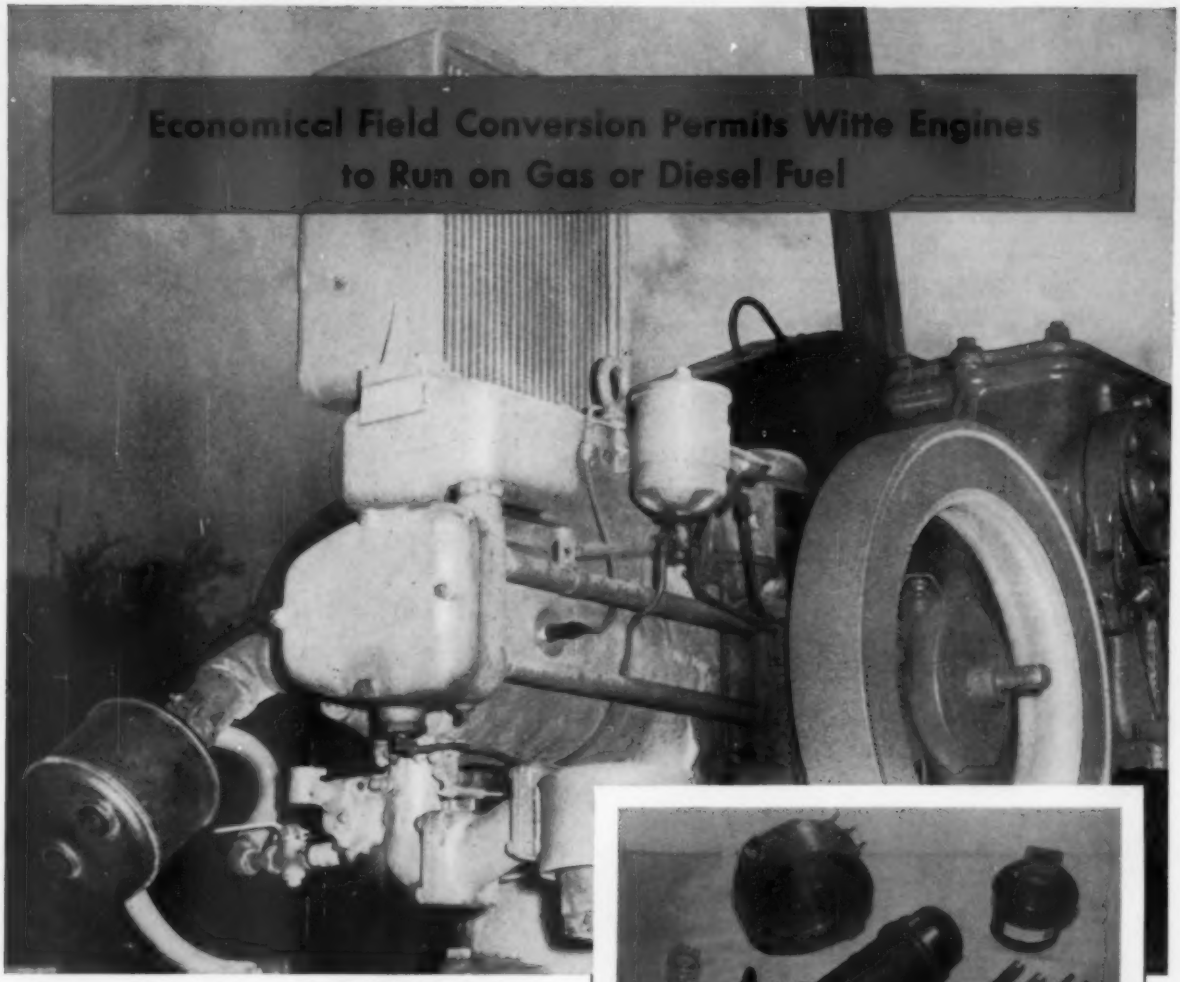

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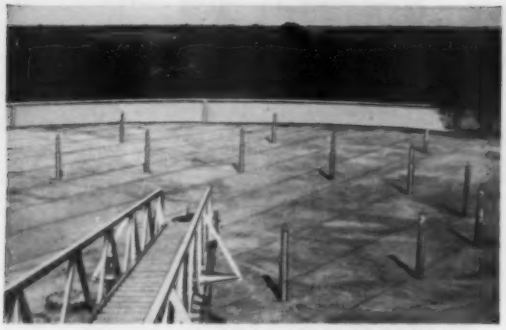

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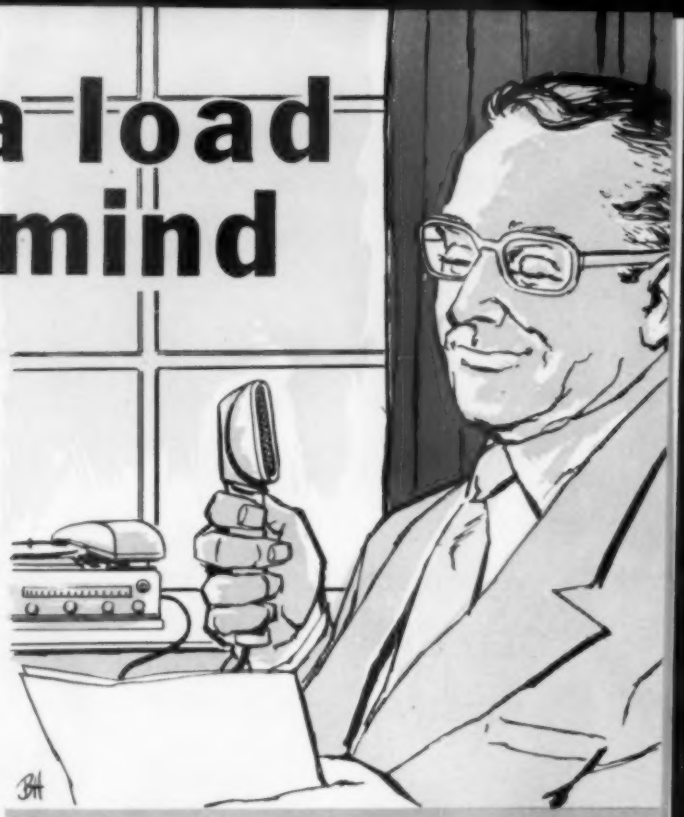

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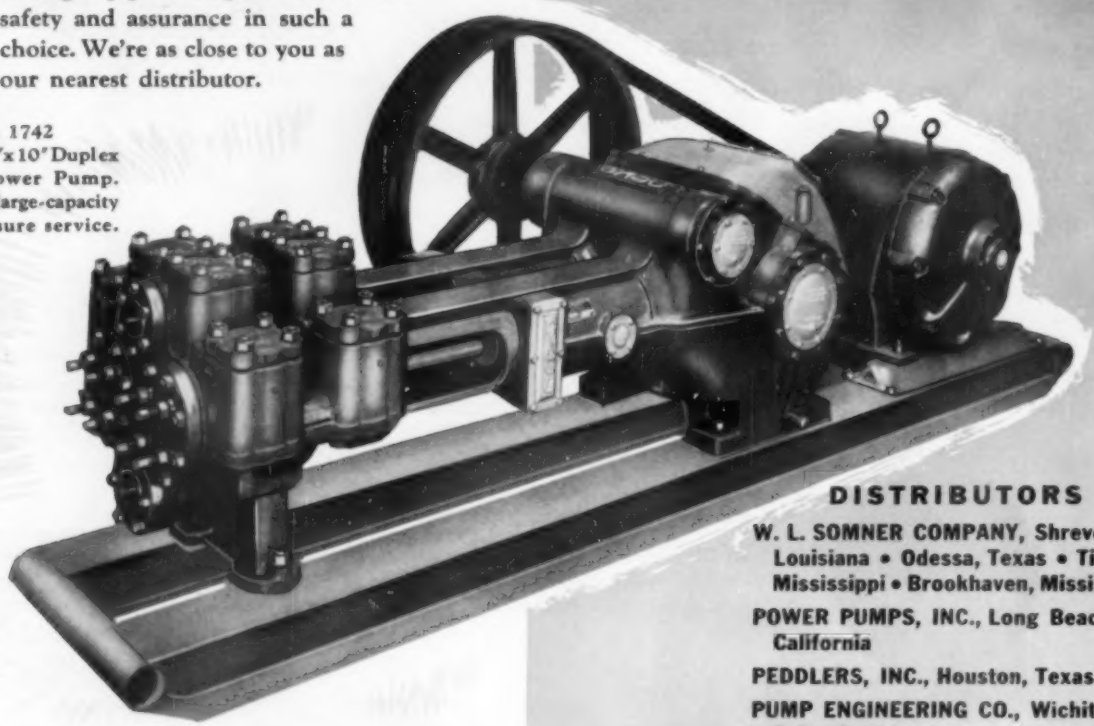

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W. L. SOMNER COMPANY, Shreveport, Louisiana • Odessa, Texas • Tinsley, Mississippi • Brookhaven, Mississippi

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HAGUE EQUIPMENT CO., INC. Evansville, Indiana

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GASO PUMP & BURNER MFG. CO.
TULSA, OKLAHOMA
Export Office: 149 BROADWAY, NEW YORK

GOODYEAR INDUSTRIAL PRODUCTS
G.T.M.-Specified ORTAC for hot-oil cleaning of well casings
A
B
C
A Extra-tough cover resists weather, oil, sun, abrasion
B Vertical braids of high-tensile rayon cord for exceptional strength with great flexibility
C Tube that resists oil, gasoline, solvents, air and water
ORTAC (Oil-Resistant Tube and Cover) is available in long, continuous lengths in sizes from 3/16" to 1½" i.d.

One cleaning hose: 300 wells—well done

Cleaning paraffin from well casings – with oil heated to a smoking 170°F.—quickly burned the life out of the different brands of ordinary hose this Texas rig operator tried. In fact, 5 weeks' service was the record for any of them.

Then he called in the G.T.M. – Goodyear Technical Man. The recommendation: ORTAC – the rugged hose with a tube of oil-resistant synthetic rubber. To date, this hose has put in *two solid years of service – cleaned over 300 wells* and cleaned them well. And it's still going strong.

That's one more example of time- and money-saving help from the G.T.M. It's typical, too, of service from Goodyear hose and other industrial rubber products – throughout the oil fields. To cash in, contact the G.T.M. through your Goodyear Distributor—or by writing Goodyear, Industrial Products Division, Akron 16, Ohio.

ORTAC by

GOODYEAR

THE GREATEST NAME IN RUBBER

Ortac –T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

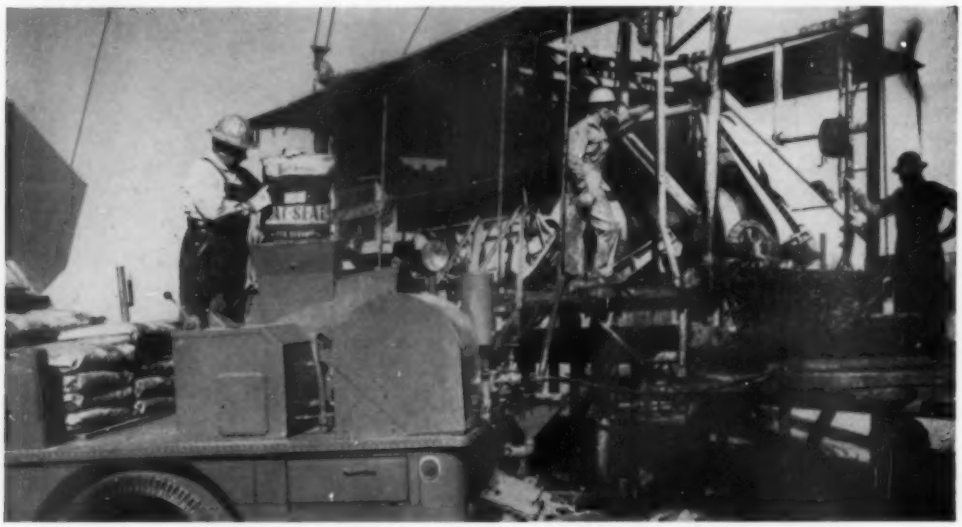
IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*

Remedial Time-Saver

Cost of running in strings of drill pipe or tubing is saved when you have remedial cementing done by . . .

HALLIBURTON'S

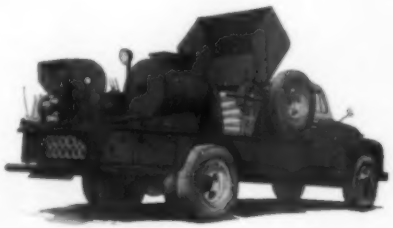
dump bailer service



. . . because bailer containing cement is run in and out of hole on wire line . . . faster, more economically.

Wherever amount of cement needed is not too large and well is not too deep for bailer placement, save money by cementing with "no strings" of drill pipe or tubing. Call the world's most experienced Dump Bailer cementers.

This truck is one of the fleet of Halliburton Dump Bailer units. It carries all materials and equipment needed for Dump Bailer jobs such as . . .



Nitroglycerine shot tamps
Plug back jobs
Bridge in pipe for repairs
Water shutoff
Securaloy removal
Bridge for uphole treatments

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

These Halliburton Products Improve Dump Bailer Cementing...

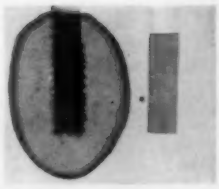
HALLIBURTON'S CAL-SEAL
EXPANDS AS IT SETS, MAKES TIGHTER PLUG

This quick-setting, super-strength gypsum cement is most popular for Dump Bailer jobs... bridge plugs, split pipe, blowouts, shot tamps. It expands 0.3% (linear) during setting, which tightens plug in hole or fissure.

Cal-Seal develops a compressive strength of 2500 psi one hour after setting. The set product is readily drillable, low in permeability, easily applied and economical.

HALLIBURTON'S RESIN-CEMENT
FILTRATE PENETRATES FORMATION FOR TIGHT SEAL

Where oil production is hard to protect from fluid migration or water coning, Halliburton's Resin-Cement placed with Dump Bailer has successfully sealed troublesome formations in many wells. The fluid phase penetrates the formation, providing an impermeable seal and sets in continuity with the cement plug.



RESIN-CEMENT

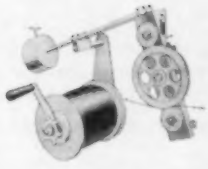
HALLIBURTON'S "DB" BRIDGING BASKET
HELPS SPOT REMEDIAL CEMENTS WHERE WANTED

This useful tool aids remedial work off bottom of open hole or inside casing. Attached to Bailer section by special adapter, it is lowered to any depth in open hole or casing with a quick-setting material in the Bailer. A slight pickup of the Bailer sets and opens the Bridging Basket and dumps the material on top of the basket.

"DB" BRIDGING BASKET

HALLIBURTON'S STANDARD MEASURING DEVICE
WORKOVER JOBS AIDED BY ACCURATE MEASUREMENTS

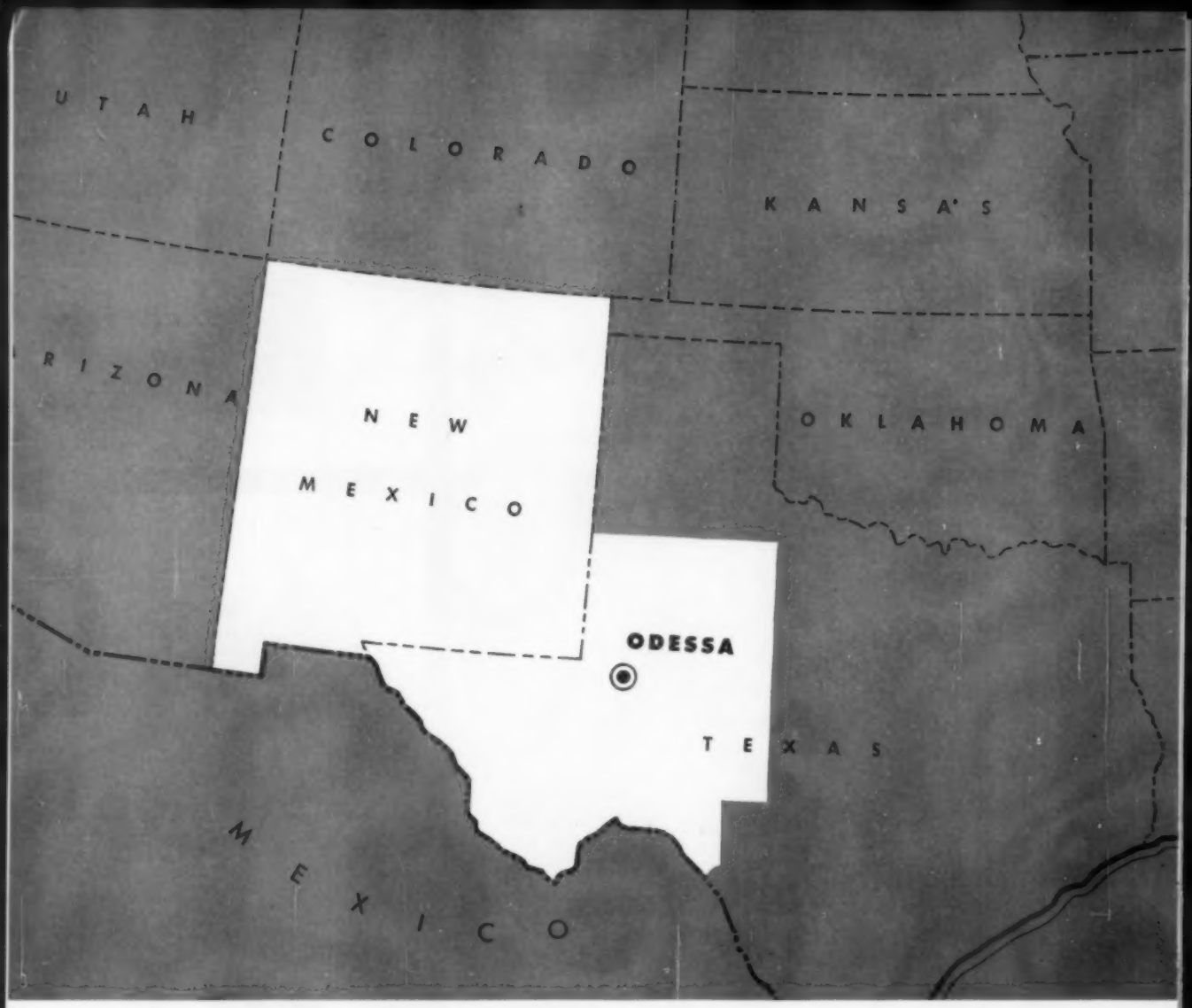
For accurately locating the zone where remedial work is needed, as well as many other purposes, Halliburton's Standard Measuring Device eliminates many errors due to guesswork and miscalculations. The Veeder counter reads exact depths directly in feet or meters. This device is one of many superior measuring devices and assemblies manufactured by the world's oldest and most experienced maker of oil well measuring line equipment.



STANDARD MEASURING DEVICE

Dump Bailer Service

251 SERVICE CENTERS – JUST MINUTES AWAY, CAN SAVE HOURS OF TROUBLE



In Odessa, right on Highway 80 . . .

BETHLEHEM'S NEWEST WIRE ROPE DEPOT

Serving distributors and their customers from West Texas to the "Four Corners" area, Bethlehem's Odessa mill depot is now in full operation. It offers an unsurpassed selection of wire ropes for oil-country use—the proper sizes and types for rotary and cable-tool lines, coring and sand lines, well-servicing lines, etc. Also stocked are many kinds of industrial ropes for power shovels, draglines, winches, and other equipment.

The purposes of this depot are as follows:

(1) To back up distributor stocks in the area covered

To reach the Odessa mill depot by phone, call

FEDERAL 7-6681

Address: 1800 E. Second St. (Hy. 80)

(2) To serve distributors' customers where direct delivery is wanted

(3) To render technical field service through Bethlehem wire rope engineers

The big new depot is just a short distance from Odessa's main business section. You can't miss it. There's plenty of parking space, and loading facilities accommodate trucks of all sizes.

The addition of this West Texas unit makes possible faster, more personal service to Bethlehem distributors and their customers. Orders can usually be shipped the same day received. By all means stop in and inspect the set-up when you're next in Odessa.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

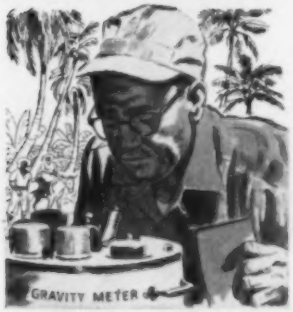
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

How Standard put $4,282,372 to work every day last year

...and what this meant to people in the Western Hemisphere



Port of Spain, Trinidad Exploration for possible new sources of oil covered millions of acres in the U.S., Central and S. America, Canada, Alaska and Bahama Is. Seeking oil for your future use is one of our biggest expenditures . . . $324,789 on an average day. In 1956 we found more new oil than our wells pumped from the ground.

Gulf of Mexico We completed better than two new wells a day . . . 101 off the Gulf Coast where drilling costs up to six times as much as on land. An average day's drilling bill came to $431,516. This huge sum was necessary because a well may cost from $125,000 to over $1,000,000 and one out of every six drilled was a dry hole.

Vancouver, B. C. On an average day Standard spent $517,446 to keep equipment in repair and up to date . . . extending a wharf at Vancouver or a pipe line to Boise, Idaho. This work provided employment for thousands of construction and maintenance workers as well as for the employees of the firms supplying equipment.

El Paso, Texas Purchases of crude oil took $949,853 a day in areas such as El Paso, Texas and Bakersfield, California. Although our own Western Hemisphere production was at a new high, we bought oil from many small and medium sized producers. To these people Standard was a good customer and an important source of income.

Salt Lake City, Utah Our 738 employees in Utah were among the total 38,854 who participated in benefit plans at the rate of $119,082 a day. Under our Stock Purchase Plan, Standard added nearly twice the amount an employee deposited. Other plans included sickness benefits, retirement pay and Company-paid life insurance.

Bajo Grande, Venezuela Increasing refinery output and improving products are never-ending jobs. Last year one of our operating companies completed a new asphalt refinery in Venezuela and plans were announced for a future refinery in Washington. New equipment for our manufacturing plants cost $107,741 a day.

U. S. A. Our Federal, State and other taxes amounted to $325,424 a day . . . enough to buy a helicopter for rescue work, or pay for complete training of three jet pilots every day. In 1956 Standard also collected for and passed on to Municipal, Provincial, State and Federal agencies $193,460,383 as sales and gasoline taxes.

Berkeley, Calif. Although 43.5% of Standard's owners live in the West, Alaska, and Hawaii, you'll find them almost everywhere. Stockholders include colleges, churches and banks, but most are individuals. Of every dollar we took in last year, 6-6/10¢ or $285,028 a day went to our 137,381 stockholders who own the Company.

WHAT HAPPENED TO THE $1,567,348,030 STANDARD TOOK IN LAST YEAR can best be told in terms of people . . . many people in many lands. For example, Standard was a customer of more than 10,000 Western firms last year. One major item such as a refinery unit required the services of people in scores of other industries.

Moreover, many of the 1250 products we made from petroleum were raw materials for other manufacturers . . . from paints to cosmetics, from detergents to synthetic fabrics. Thus you'd never be able to count the people who benefited directly or indirectly from the $4,282,372 Standard put to work every day last year.

Through affiliated companies operating in the Eastern Hemisphere, Standard helped carry on expansion and development programs that provided better living for people in Europe, Africa, the Middle East and the Far East. For complete, interesting details write for a copy of our Annual Report: Standard Oil Company of California, Room 2153, 225 Bush Street, San Francisco 20, California.

STANDARD OIL COMPANY OF CALIFORNIA

plans ahead to serve you better

for Deeper, Safer Drilling— New VHS Drilling Lines

• In Louisiana, West Texas, the Williston Basin, the Gulf of Mexico —drillers everywhere are demanding the advantages offered by rotary drilling lines of new LAY-SET VHS. For new VHS lines are 15% stronger than those made of Improved Plow Steel—the strongest grade available before the introduction of VHS.

HIGHER SAFETY FACTOR

Obviously this means a higher safety factor. For example, 10 lines of VHS have a safety factor about equivalent to 12 lines of Improved Plow Steel. Or, with 10 lines of VHS you get a safety factor 14.9% or 15% higher than with 10 lines of IPS.

SAVE TIME!

With stronger VHS you can drill deeper before increasing the number of parts of line. You can make round trips faster. And the extra strength of VHS eliminates in many cases any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

TOUGHER, TOO!

In addition to its greater strength VHS is tougher. It has greater resistance to abrasion and higher resistance to peening—both important factors in maintaining shape and diameter. Following regular, adaptable cut-off practices should result in ton-mile advantages.

IN STOCK NOW

Call your Hazard distributor for LAY-SET VHS drilling lines in the length and diameter you need. He probably has them in stock—or he can get them fast. You don't need any complicated specifications.

for further information write to the nearest Hazard office for Brochure DH-522

LAY-SET VHS

15% Stronger • Tougher •

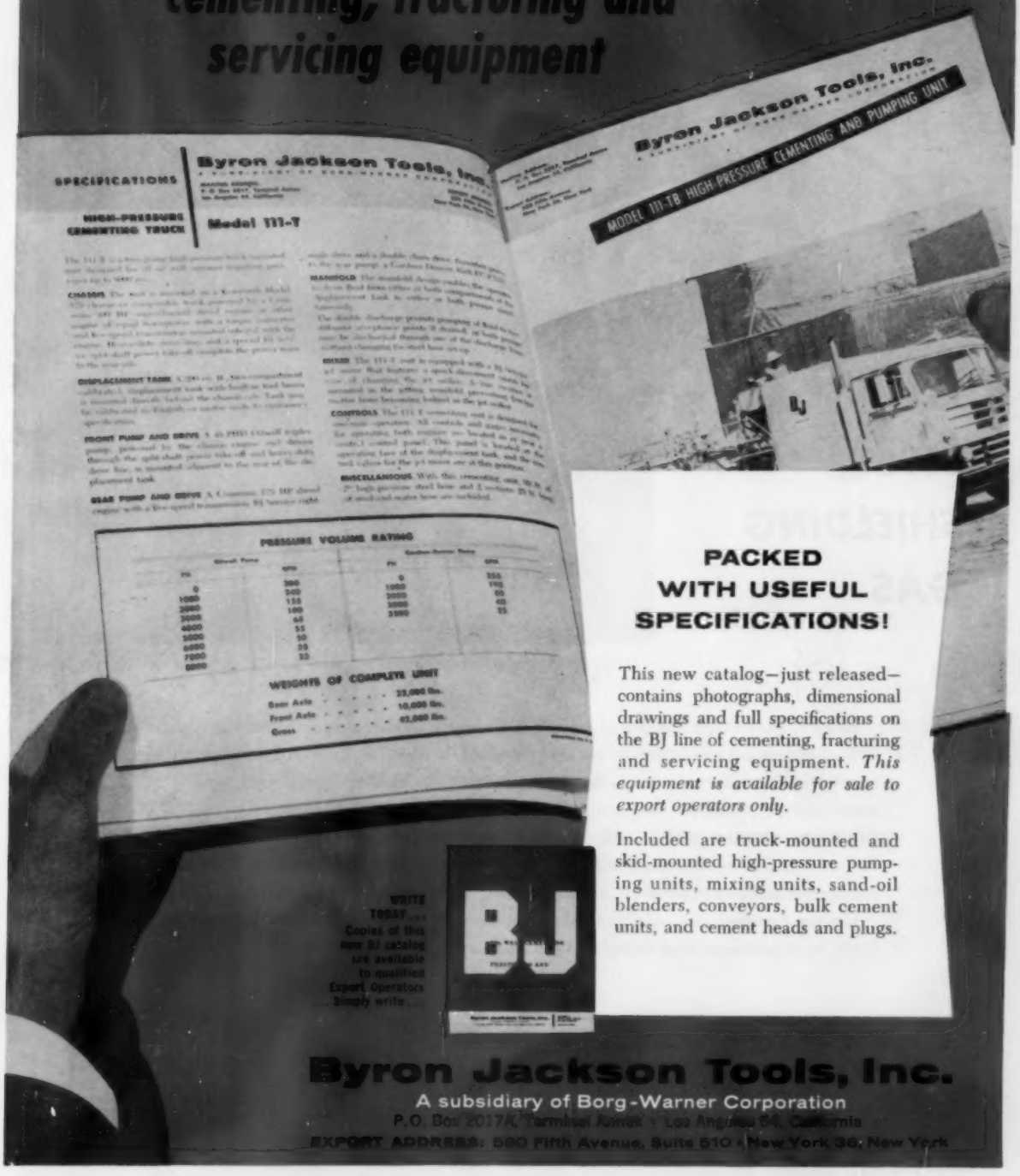
HAZARD WIRE ROPE DIVISION
American Chain & Cable Company, Inc.

630 McFarland St. Houston 1, Texas | 4555 E. 46th Ave. Denver 16, Colorado | 2216 S. Garfield Ave. Los Angeles 22, Calif. | 400 W. Madison St. Chicago 6, Ill.

Wilkes-Barre, Pa.; Odessa, Texas; New York, N. Y.; Philadelphia, Pa.; San Francisco, Calif.

ATTENTION: EXPORT OPERATORS

New BJ catalog of oil well cementing, fracturing and servicing equipment


SPECIFICATIONS
Byron Jackson Tools, Inc.
HIGH-PRESSURE CEMENTING TRUCK
Model 111-T
Byron Jackson Tools, Inc.
MODEL 111-TB HIGH-PRESSURE CEMENTING AND PUMPING UNIT
PRESSURE VOLUME RATING
WEIGHTS OF COMPLETE UNIT
WRITE TODAY... Copies of this new BJ catalog are available to qualified Export Operators. Simply write...

PACKED WITH USEFUL SPECIFICATIONS!

This new catalog—just released—contains photographs, dimensional drawings and full specifications on the BJ line of cementing, fracturing and servicing equipment. *This equipment is available for sale to export operators only.*

Included are truck-mounted and skid-mounted high-pressure pumping units, mixing units, sand-oil blenders, conveyors, bulk cement units, and cement heads and plugs.

Byron Jackson Tools, Inc.

A subsidiary of Borg-Warner Corporation

P.O. Box 2017A, Terminal Annex • Los Angeles 54, California

EXPORT ADDRESS: 580 Fifth Avenue, Suite 510 • New York 36, New York

NOW...

QUALITY WELDS

like these...

with up to

60%

LESS SHIELDING GAS

H-15 argon-hydrogen mixture means new economy in fast, sound welding operations.

Using H-15, a LINDE mixture of argon and hydrogen shielding gases, savings as high as 60% of normal gas consumptions are being attained by manufacturers on a wide variety of metal products. This mixture is designed for extremely efficient mechanized welding of stainless steel, Monel, Inconel, and cupro-nickel.

COMBINES ADVANTAGES—H-15 mixture combines the high welding speed feature of Helium with the low consumption advantages of argon—result, the lowest cost, high-quality welding yet attained . . . And no extra equipment is needed for a change over to H-15.

Get the complete story of this highly efficient, economical mixture, contact your local LINDE representative. Start saving now—do it today.

LINDE COMPANY
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, New York
Offices in Other Principal Cities

Linde
TRADE-MARK

UNION CARBIDE

In Canada: Linde Company, Division of Union Carbide Canada Limited.

The terms "Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

ALL DRESSED UP... AND Going Places!

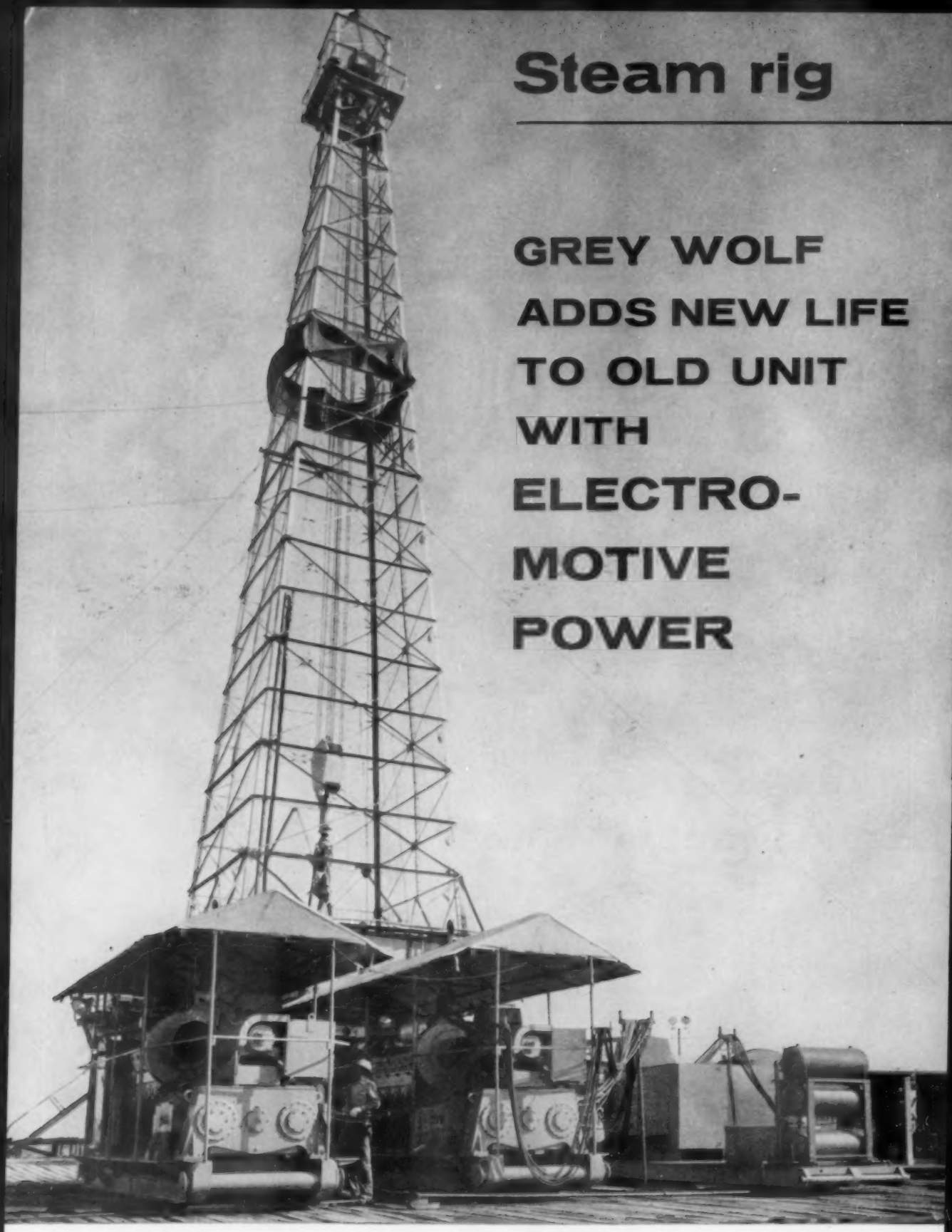
Here's the "New Look" in the Oil Country. Sleek new cars dressed up with the brightest name in service and equipment . . . Continental-Emsco.
Look for Continental-Emsco's new cars and stores throughout the oil country — it promises that you can count even more on Continental-Emsco to provide the best equipment and service to the oil and gas industries.
Continental-Emsco Company (a division of The Youngstown Sheet and Tube Company), General Offices: Dallas, Texas; Plants: Los Angeles, Houston and Garland, Texas; Export Offices: 45 Rockefeller Plaza, New York.

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

Steam rig

GREY WOLF ADDS NEW LIFE TO OLD UNIT WITH ELECTRO-MOTIVE POWER



Two skid-mounted Electro-Motive 875-hp generating sets power Grey Wolf's recently converted rig. Each 8-cylinder engine drives two 500-kw dc generators that supply power to electric drive motors on draw works, rotary and mud pumps. Electrical control cabinet is located on skid to right of engines.

converted to Diesel-Electric

Grey Wolf Drilling Company of Houston expects its newly converted Diesel-Electric rig will cut rig-up time to three days—just half the time it took with the old steam unit.

In addition, "trips" are faster with the new rig and drilling speeds were judged faster on two locations where depths up to 13,000 feet were reached. Maximum drilling depth is well beyond 17,000 feet.

Why Diesel-Electric?

Grey Wolf saw two distinct advantages: Diesel-Electric would adapt readily to present components, thus reduce costs; and because components are connected by flexible electric cables, the rig could be broken into skid-mounted packages for fast transport and quick rig-up.

Why Electro-Motive Power?

A "packaged" system was one reason Grey Wolf decided on Electro-Motive Power. For this system is designed and built to work together—one manufacturer—one source of responsibility. Other reasons were the accurate control and torque characteristics of Electro-Motive Power plus its demonstrated economies of long life and low maintenance on both land and offshore rigs.

Have you considered the advantages of Diesel-Electric for your drilling operations? Contact your Electro-Motive Representative for complete details.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS · La Grange, Ill.
In Canada: General Motors Diesel Limited, London, Ontario
Petroleum Industry Sales Offices: Dallas and Houston, Texas; Morgan City, Louisiana; Los Angeles, California.

See Electro-Motive's unique drilling power demonstration at the General Motors Exhibit, Oklahoma Semi-Centennial Exposition, Oklahoma City, June 14-July 7.

View from derrick floor shows simple arrangement of components on ground. Single 625-hp dc electric motors drive mud pumps. Electric cables run from generating units to various motors on overhead runways. Flexible cables permit placing equipment to fit location conditions.

Driller's control stand provides maximum visibility for every operation. Simple, sensitive controls provide smooth and rapid acceleration of loads with positive control of speed and torque. From this one panel, driller has complete control of all Diesel-Electric equipment.

Now...load rate your bearings at higher values

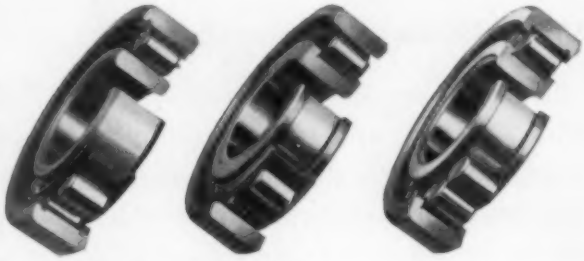
with Tru-Rol CROWNED ROLLERS

Greater capacity . . . longer life . . . or a precisely balanced gain of *both* factors. That is the choice offered you by the "crowned" rollers of Tru-Rol bearings.

By finish grinding a carefully selected crown radius on roller ends, Rollway relieves high stress areas, insures uniform distribution of load over the entire length of the roller. Rollers can take heavier loads without excessive end-fatigue, and are less subject to the effect of slight misalignment or deflection.

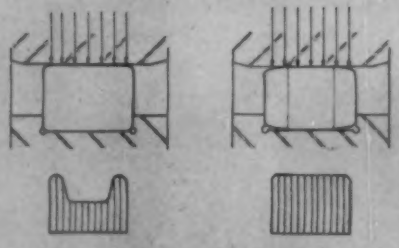
The result is load rating at higher values for greater capacity, longer service life . . . or both. If this choice interests you, why not write for the complete story. Rollway Bearing Co., Inc., Syracuse, N. Y.

Tru-Rol Bearings with crowned rollers are available in 3 types



Stamped Steel Retainer with Guide Lips | Segmented Steel Retainer | Full Roller

Comparative Stress Patterns under Uniform Loads for Straight and Crowned Cylindrical Rollers



Stress pattern for a straight cylindrical roller under load. Note uneven end-loading.

Stress pattern for crowned roller under load. Crowning radius is exaggerated for clarity.

● Rollway engineering service is available to help you select exactly the right bearings for your needs. Write us.

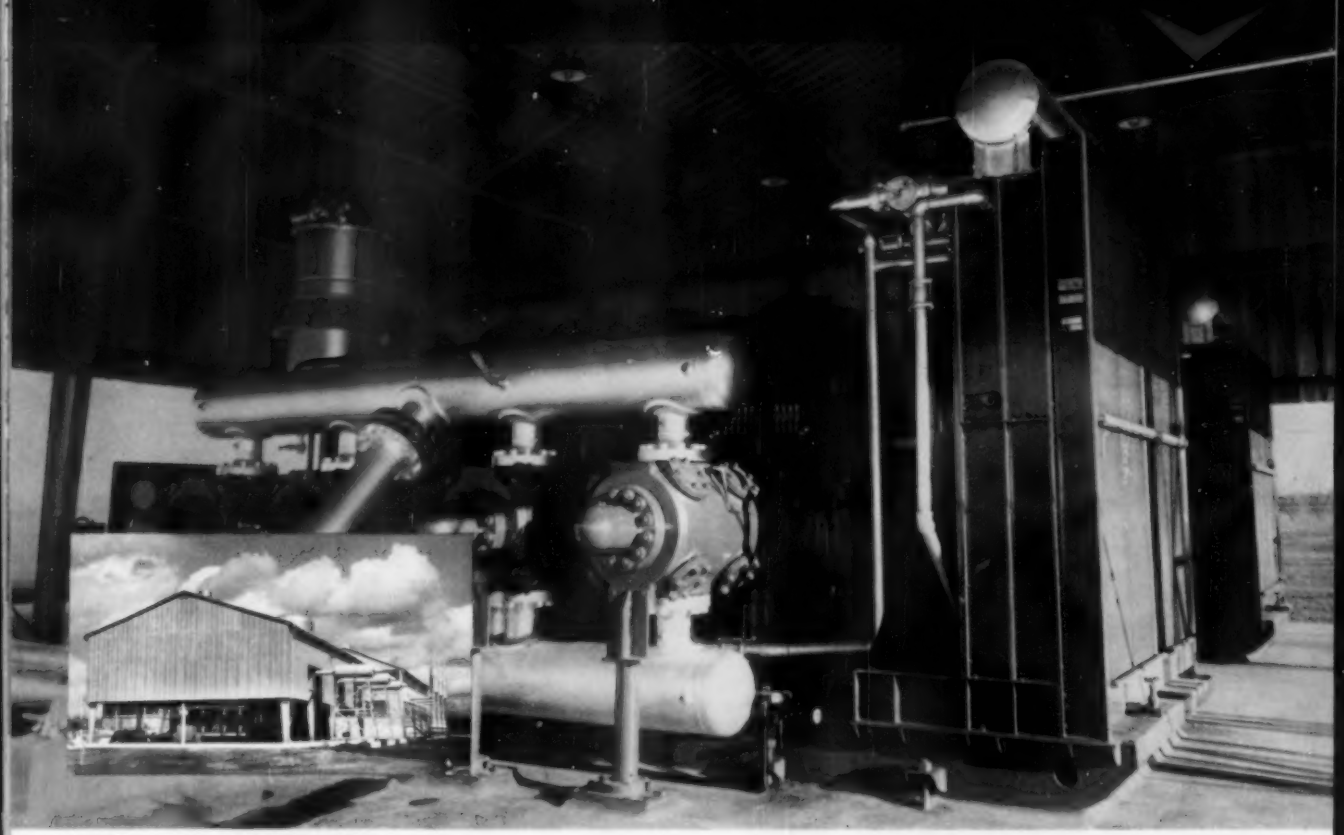
ROLLWAY BEARINGS

COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS

ROLLWAY REPLACEMENT BEARINGS are available through authorized distributors in principal cities. Consult the yellow pages of your telephone directory — under "Bearings".

ENGINEERING OFFICES: Syracuse • Boston • Chicago • Detroit • Toronto • Pittsburgh • Cleveland • Milwaukee • Seattle • Houston • Philadelphia • Los Angeles • San Francisco

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant



SOUTHERN NATURAL GAS COMPANY's White Castle Supply Line Station, equipped with two Beaird-Ingersoll-Rand 10-SVG, 550 h.p. packaged compressors. Shown in inset is the Toca station where three 12SVG, 660 h.p. Beaird packaged compressors have been installed to supplement three large stationary units. Other sizes available from 120 to 660 h.p.

Economical Expansion —

PACKAGED UNITS ADDED TO STATIONARY COMPRESSOR INSTALLATION

SOUTHERN NATURAL GAS COMPANY's growing supply line systems are reaching toward the Gulf on both east and west sides of New Orleans. Pacing this expansion are two new packaged compressor installations boosting the increased gas volume to the main supply line station at Gwinville, Mississippi. The east side line is handled by the enlarged compressor station at Toca, Louisiana. Formerly equipped with three large stationary compressors, this plant has been expanded by adding three 12SVG 660 h.p. Beaird-Ingersoll-Rand packaged units. On the west line a new station at White Castle equipped with two 10SVG 550 h.p. units is offsetting the increased line pressure from Toca station and handling added gas volume.

Southern Natural selected packaged compressors for their expansion program as a result of their field experience. Package units have proved more flexible in service, were more economical to install, required less foundation work and when no longer needed can be almost wholly salvaged. Packaged compressor equipped stations have also been found to be easier and more economical to design for future horsepower additions.

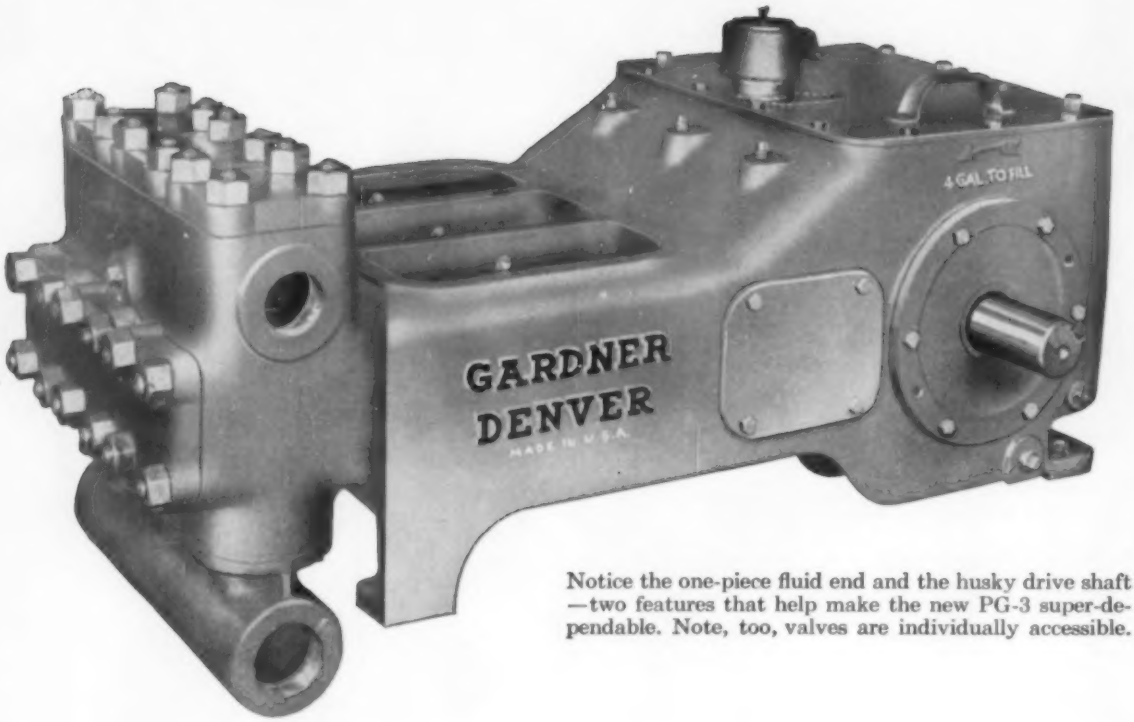
Let us show you how economically Beaird-Ingersoll-Rand packaged compressor plants can be added to your compressor station.

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

LOWEST COST PER HORSEPOWER INSTALLED

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A subsidiary of American Machine & Foundry Company

SHREVEPORT, LOUISIANA • *Sales Offices: Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado Los Angeles, California • Caracas, Venezuela, and Cie. Ingersoll-Rand, Paris, France.*



Notice the one-piece fluid end and the husky drive shaft —two features that help make the new PG-3 super-dependable. Note, too, valves are individually accessible.

INTRODUCING THE PG-3

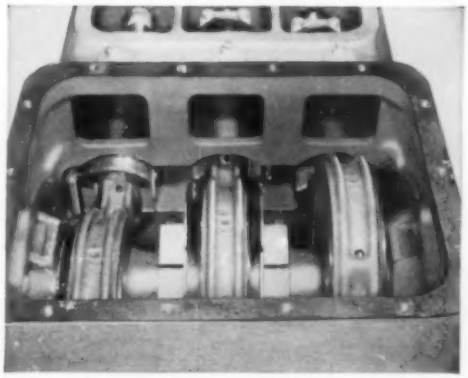
. . . new Gardner-Denver waterflood pump

In this new triplex plunger pump you get famous Gardner-Denver reliability that keeps costs down. With this addition to the line, you can choose with more exactness than ever the Gardner-Denver pump for salt water disposal and waterflood service that meets any set of field conditions.

GARDNER-DENVER WATERFLOOD PUMPS—CONDENSED SPECIFICATIONS

Model	PL-7 6-cyl.	PA-8 Triplex	PE-5 Triplex	FG-FXG Duplex	FF-FXF Duplex	PG-3 Triplex	LE-LXE Duplex
Type	plunger	plunger	plunger	piston	piston	plunger	piston
Input hp —up to	240	160	75	60	40	30	24
Discharge psi —up to	3,360	1,455	2,700	895	640	3,050	820
Bbl. per day —up to	13,200	9,000	7,300	6,000	4,500	1,600	3,000

For higher pressures, consult your Gardner-Denver representative. Complete specifications on the new PG-3 and on any or all of the six other pumps will be sent to you promptly on request.



Here's the eccentric drive. It permits use of the straight shaft of large diameter. The new PG-3 also has one-piece connecting rods—a third contribution to dependability under any operating conditions.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois—Gardner-Denver Export Division, 233 Broadway, New York, N. Y. In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ont. Oil Field Offices: Dallas, Houston, Tulsa, St. Louis, Los Angeles, New York, Pittsburgh, Denver, New Orleans, San Francisco, Kansas City, Winnipeg, Edmonton.

ALL FORGED STEEL

Edward

STOP AND CHECK VALVES

For Pressures Up To 7500 lbs

FIG. 158

Rated for 7500 lbs at 125F in 2 in. sizes, and for 6000 lbs at 125F in the ½ to 1½ in. sizes, Edward's complete line of all forged steel high pressure valves are used in thousands of applications involving excessive pressures and temperatures under 300F. Fig. 158 stop valves, in either globe or angle styles, provide fast, certain shut-off or accurate pressure control. Fig. 160 check valves protect costly equipment, eliminate danger by preventing sudden reversal of flow.

Construction Features Like These Give Longer Life, Reduce Replacement Costs And Lower Maintenance Time:

FIG. 158 STOP VALVES

- Drop forged steel bodies specially heat treated.
- Stem at 60 degree angle to reduce wear producing turbulence, lower pressure drop.
- Seat, disk, and stem of EValloy 13% chromium stainless steel.
- Renewable screwed in seat with long threads below pressure joint for leak proof seating.
- Inside screw construction, deep stuffing box and special gland and packing nut design to lengthen packing life.
- Bonnets EValized by exclusive plating process for maximum corrosion and abrasion resistance.
- Body contours streamlined for free flow with low pressure drop.
- Stem of EValloy stainless steel, centerless ground to fine finish, long wearing Acme form threads, backseating shoulder.

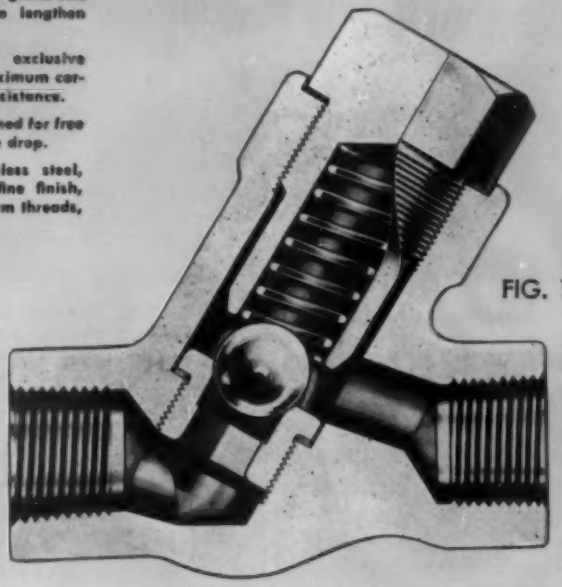


FIG. 160

FIG. 160 CHECK VALVES

- Body and seats identical with globe or angle valves above.
- Rolled steel bonnet with two ribs for guiding ball to accurate seating.
- Balls of corrosion resistant, high carbon stainless steel accurately ground for tight seating.
- High Carbon stainless steel springs, sufficiently long to provide positive aid in seating ball in services involving heavy viscous fluids.

Available in Wide Range of Sizes and Styles

- Stop valves furnished in globe or angle styles.
- Check valves furnished in horizontal or vertical styles.
- All valve styles furnished in sizes ¼", ⅜", ½", ¾", 1", 1¼", 1½", 2".
- All valve styles furnished with either screwed or socket welding ends.

Edward builds a complete line of cast and forged steel valves for pressures from 150 lbs to 7500 lbs, including globe and angle stop valves, gate valves, non-return valves, blow-off valves, feedline stop-check valves, integral bonnet Univalves, relief valves, hydraulic valves, instrument valves, gage valves and strainers. Write for Catalog 104.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

1212 West 145th Street, EAST CHICAGO, INDIANA

Another Product

PLANES THAT OUTRACE THE SUN...

Like Joshua, America's newest jets make the sun stand still . . . fly at speeds that "set back the clock" . . . "arrive before they start."

But such success breeds ever greater problems. For example, fuels and lubricants are whisked from tropic heat to frigid stratosphere. Fiery jets and sensitive controls demand far different lubricants. That's why years ago Texaco built the largest privately-financed jet fuel testing laboratory in America.

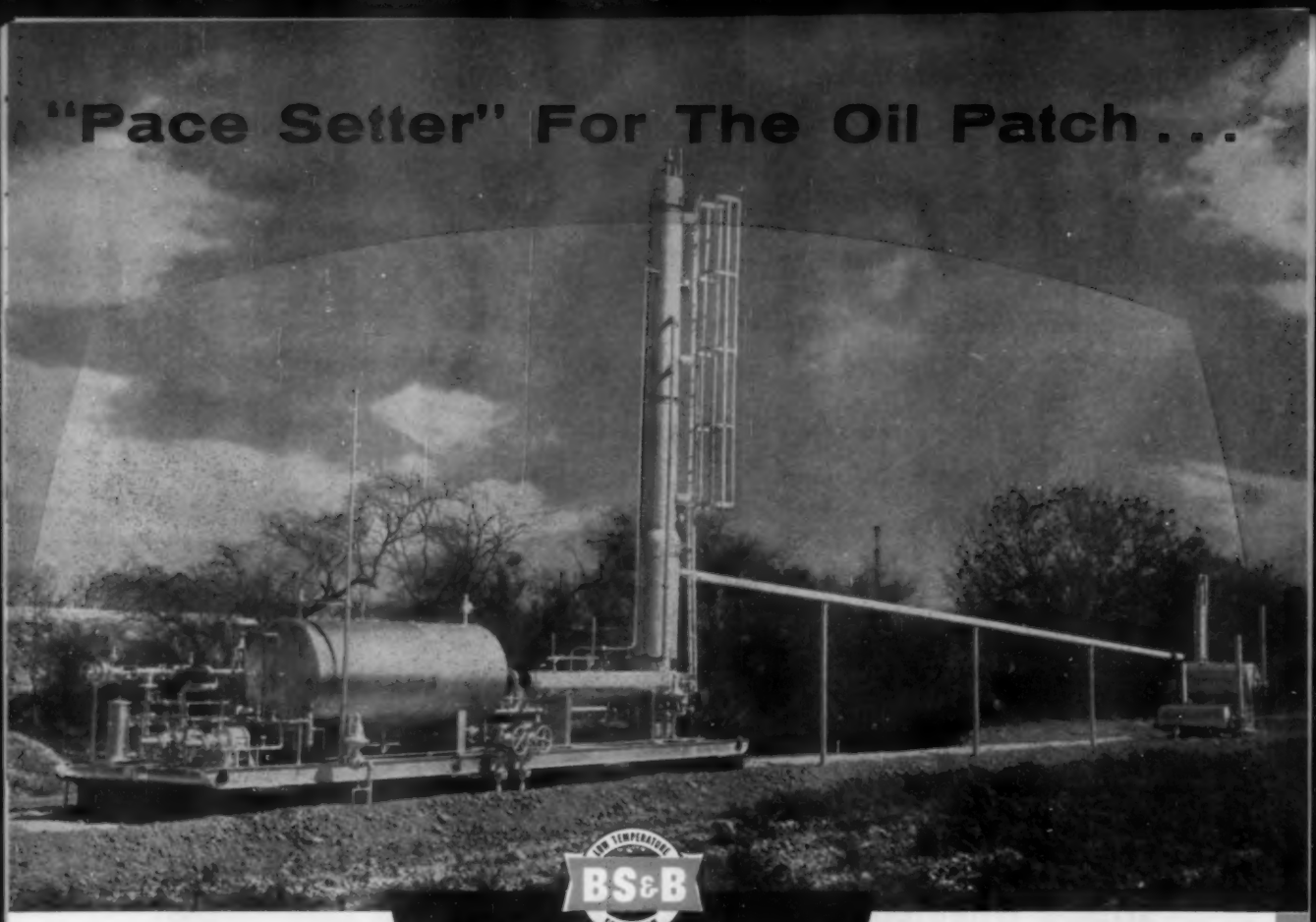
Texaco's forward-looking research meets every challenge to maintain the finest in petroleum products.

THE TEXAS COMPANY

TEXACO

progress . . . at your service

"Pace Setter" For The Oil Patch . . .



The BS&B Model GDH COLD-FRAC SYSTEM With Hydrate Inhibitor

BS&B "COLD-FRAC" Units with hydrate inhibitor (Model GDH) were especially developed for gas-condensate wells having an available pressure drop of 500 psi or greater, where gas dehydration and hydrocarbon dew point control present a problem.

The outstandingly successful performance of these Model GDH units in producing a maximum volume of condensate, and in dehydrating the processed gas to pipeline specifications, is due in part to the fact that each unit is specifically engineered to fit the conditions at the lease where it is to be operated.

If you are not now using a BS&B Model GDH "COLD-FRAC" Unit on your lease, why not talk it over with your BS&B Man? Or, send us the following information upon which to base our recommendation for a unit to efficiently handle your lease production:

1. Minimum inlet wellstream pressure and maximum inlet wellstream temperature.
2. Maximum wellstream flow rate.
3. A Podbielniak analysis of the wellstream (if available).
4. Liquid-Gas Ratio from welltest with test conditions.
5. Gas Transmission line pressure.
6. Desired Vapor pressure of stabilized condensate and storage pressure.
7. Presence of paraffin (cloud point of liquid from high pressure wellstream at wellhead flowing pressure and temperature).
8. Volume of salt water produced.

Basic Components of the Model GDH Unit to Separate End Products Include:

1. Inlet Liquid Knockout
2. Secondary Liquid Knockout
3. Cold Liquid-Gas Separator With Inlet Choke
4. Stabilizer

Auxiliary Components Include:

1. Wellstream Cooler
2. Product Cooler
3. Glycol Pump
4. Glycol Regenerator
5. Glycol-Oil Separator
6. Hydrate Catcher With Pressure Controller for Safety Shut-In

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oilfield Equipment Division, Dept. 1-A6A

P. O. Box 1714 Oklahoma City, Oklahoma

SUDDEN DEATH TO OIL FIRES!

Kidde wheeled units make short work of any blaze!

"One-man fire engines" are what some people call Kidde mobile fire extinguishing units . . . and with good reason! With one or two Kidde mobile units near large-scale fire hazards, there's no waiting fretfully for the fire department when fire strikes . . . you *are* the fire department!

Especially effective in fighting fires in oil, gasoline or other flammable liquids, Kidde *dry chemical* wheeled units have an on-off control *at the nozzle* (for easier operation) will give either "straight" or "fan" pattern for greater range or wider coverage. Designed for fast, easy maneuvering, Kidde *indoor* dry chemical "fire engines" pass readily through doorways with no costly waste motion, while *outdoor* models have wider-faced wheels for faster action on soft ground surfaces.

Kidde mobile fire extinguishing units are also available in CO_2 and foam types – illustrated and described below. For more information, call your nearest Kidde agent (he's in the yellow pages) or write today for Kidde's P-8 catalog.

40-GALLON FOAM UNITS

Ideal protection against flammable liquid fires, delivering more than ten times its tank capacity in fire-smothering foam. 50 feet of hose, 50-60 foot effective range.

CO_2 WHEELED UNITS

Available in 50, 75 and 100-pound single-cylinder capacities. Shut-off valve located at nozzle gives operator complete control. Especially good indoors since CO_2 gas leaves no mess to clean up after a fire.

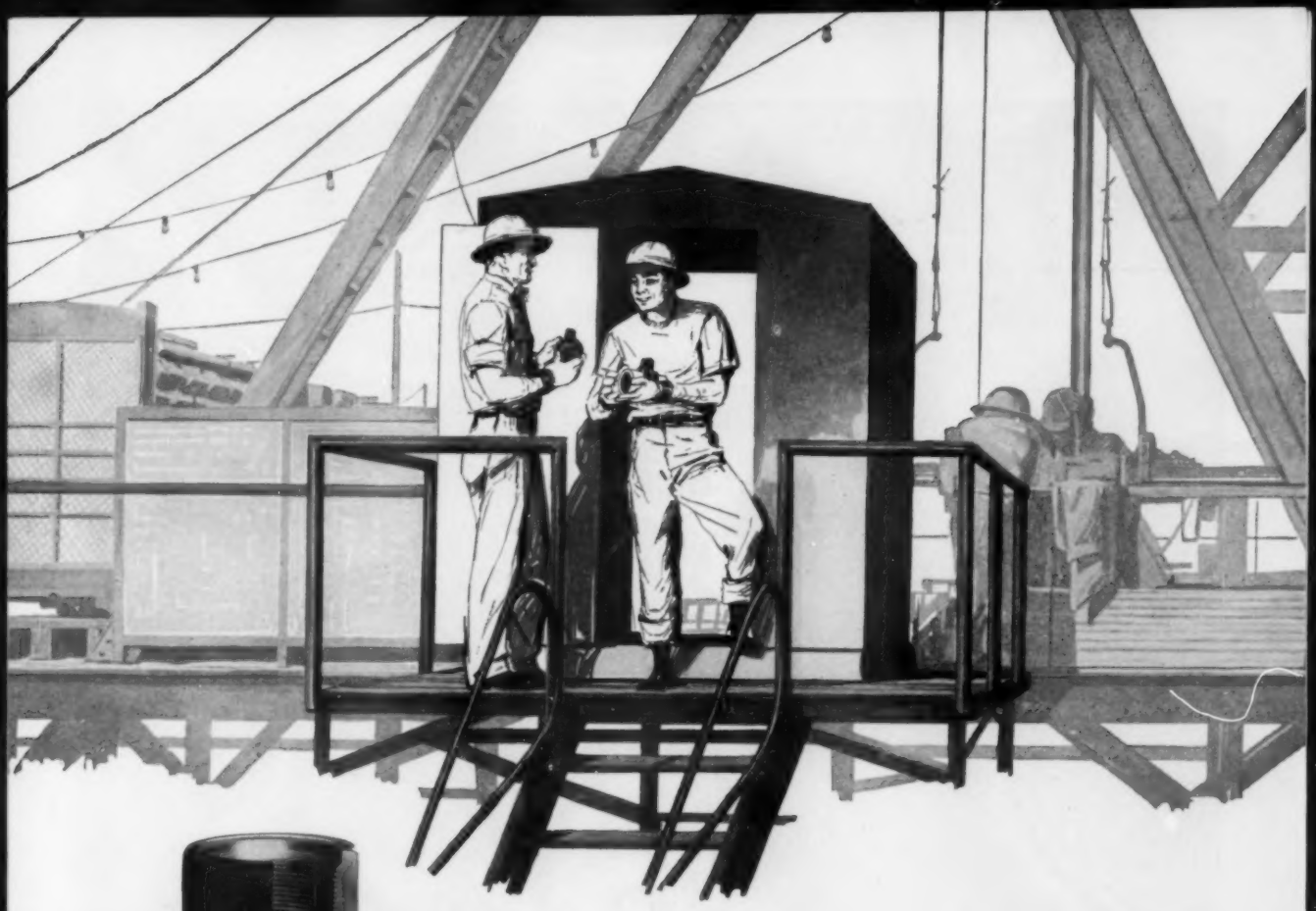
150-POUND DRY CHEMICAL UNITS

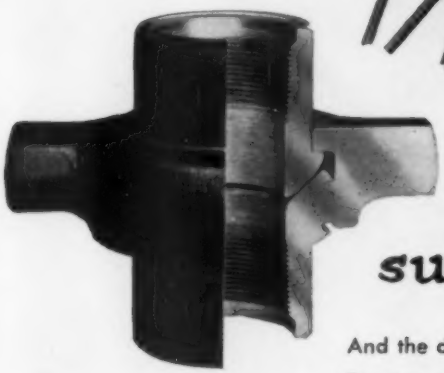
Single-lever control for "on," "off," "fan" or "straight" discharge pattern. 30-40 foot range on straight discharge. 50 feet of hose. Easily handled by inexperienced operator.

Kidde (K Kidde)

Walter Kidde & Company, Inc., 654 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal—Toronto





"I didn't realize there was such a difference in unions!"

And the difference is quite obvious when you compare Weco with other unions.

To start with—Weco's exclusive ball and cone seat design gives you the most perfect sealing possible. The spherical surface of the male sub seats on the conical surface of the female sub forming a positive, leak-proof seal. The sturdier construction of Weco Unions takes the most punishing service as part of a regular day's work. The Acme threads permit faster, easier make-up and break-out, day after day, without damage or distortion.

These differences in the design and construction of Weco Unions pay dividends in longer life and superior sealing service.

Ask for Weco Unions at supply stores everywhere. They are available in the exact size and pressure required for all oil country connections.

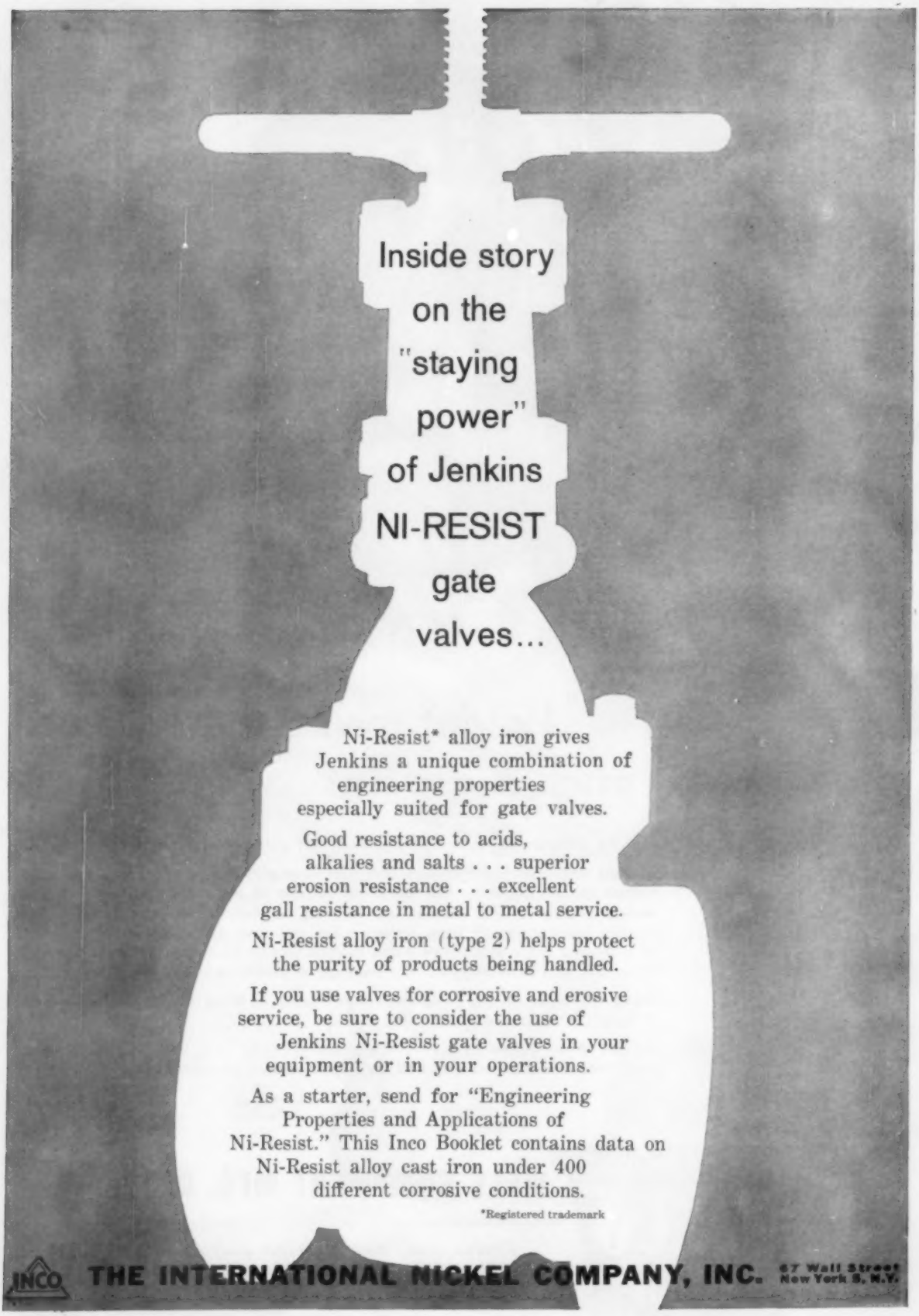
U-8-56

WECO®

WELL EQUIPMENT MFG. CORP.

HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION


Inside story
on the
"staying
power"
of Jenkins
NI-RESIST
gate
valves...
Ni-Resist* alloy iron gives Jenkins a unique combination of engineering properties especially suited for gate valves.
Good resistance to acids, alkalies and salts . . . superior erosion resistance . . . excellent gall resistance in metal to metal service.
Ni-Resist alloy iron (type 2) helps protect the purity of products being handled.
If you use valves for corrosive and erosive service, be sure to consider the use of Jenkins Ni-Resist gate valves in your equipment or in your operations.
As a starter, send for "Engineering Properties and Applications of Ni-Resist." This Inco Booklet contains data on Ni-Resist alloy cast iron under 400 different corrosive conditions.
*Registered trademark
INCO
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street
New York 5, N.Y.

for longer valve life

in a variety of corrosive services

JENKINS NI-RESIST GATE VALVES

Where you encounter acids, salt and alkaline solutions, sea water, brine or other corrosive fluids, vapors or gases, you'll want Jenkins Ni-Resist Type 2 Cast Iron Gate Valves with type 316 stainless steel trim. They have a remarkable ability to withstand destructive corrosion and erosion.

In paper mill service, food processing, petroleum refining, chemical plants and other process industries, Jenkins combination of Ni-Resist type 2 cast iron and type 316 stainless steel, plus Jenkins extra *value* construction throughout greatly extends valve life.

Designed especially for corrosive services, the Jenkins Ni-Resist line of gate valves also has superior metal-to-metal wearing qualities. Copper-free, they will not discolor or contaminate products being carried in the line. Let the famous Jenkins Diamond be your guide when choosing Ni-Resist valves . . . it means longer, trouble-free service.

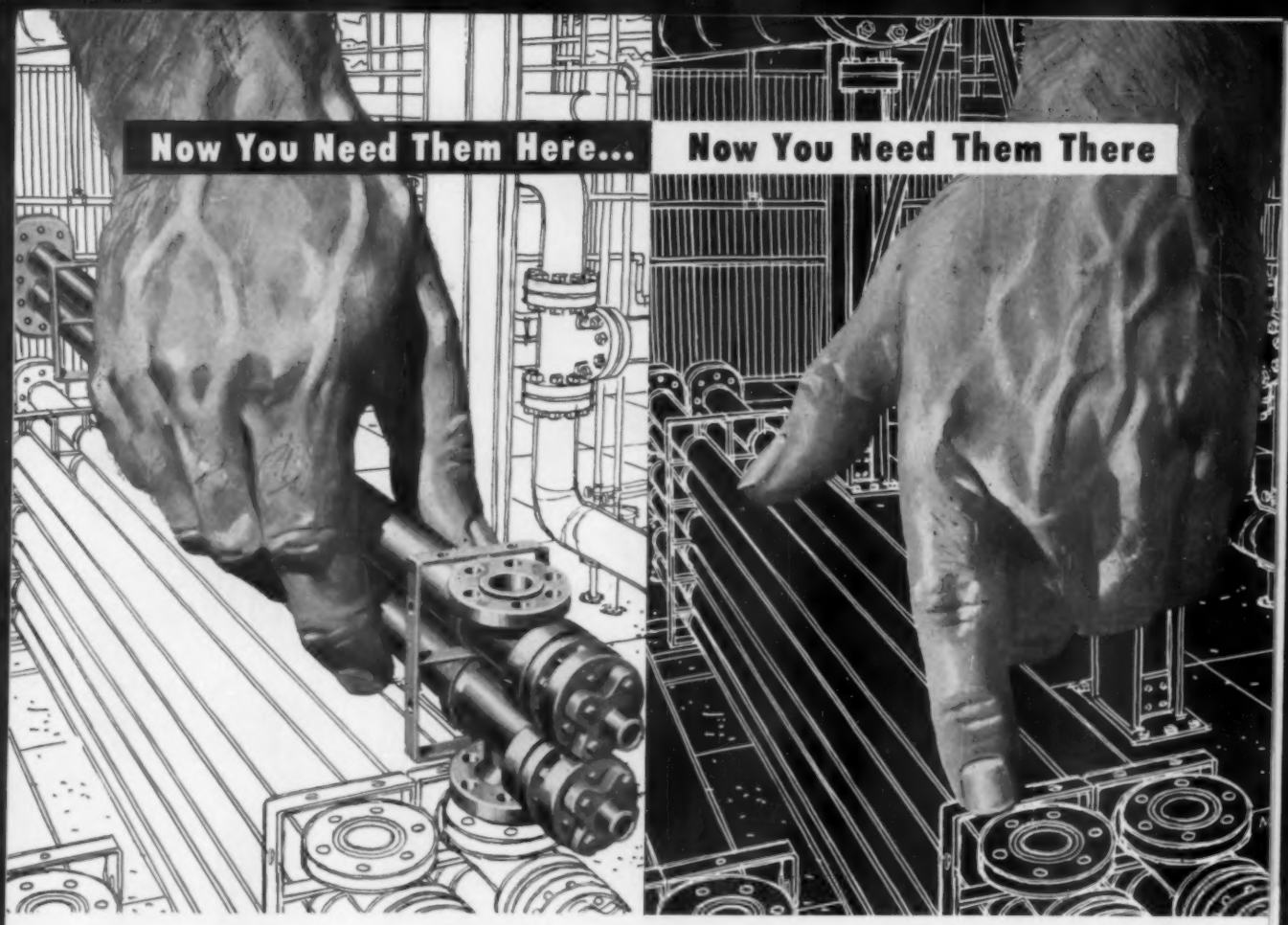
GET COMPLETE INFORMATION
from your Jenkins Distributor, or write Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Industrial Distributors Everywhere



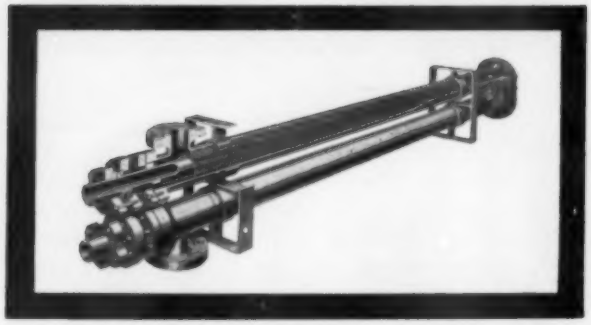
You Can Move ALCOTWIN Heat Exchangers as Loads and Processes Change

The flexibility of ALCOTWIN® heat exchangers means that you can change load or processes within your plant and still use the same heat-exchange equipment. You can easily add new ones for increased load, or you can rearrange present ones for changing conditions. They never become obsolete because of their unlimited number of applications.

ALCOTWINS are in stock in Beaumont, Texas, for immediate delivery when you need them. They are available off the shelf in a number of sizes, for pressures up to 600 psi and temperatures to 650° F.

You get real economy in first cost, in ease of installation and maintenance. In addition, you can select the precise metallurgy needed for best results in your application. The ALCO gas shielded tungsten arc welding method of fusing the fins to the tube permits the widest possible range of metallurgy.

Complete information is available from any of ALCO's sales offices. For a copy of Bulletin FH-3, write Petroleum Industry Equipment Division, Dept. AW-3, P. O. Box 1065, Schenectady, New York.



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ALCO PRODUCTS, INC.

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Locomotives · Diesel Engines · Nuclear Reactors · Heat Exchangers · Springs · Steel Pipe · Forgings · Weldments · Oil-Field Equipment

engineered prescription for effective treatment...

WESTERN'S perforation ball sealers.

Completion or remedial work, Western's Perforation Ball Sealers with fracturing and acidizing treatments are engineered to bring greater treatment effectiveness.

Whether the pay section is only 10 feet, or 400 feet, Ball Sealers provide effective blocking of the most permeable perforated zone to divert treating fluid into the tighter zones. Western provides all types of balls, rubber and nylon, to meet any well conditions, regardless of bottom hole temperatures, depth and treating pressures.

The result is complete treatment of the entire perforated section – effectively and economically. Western Perforation Ball Sealers have proved themselves in more than 700 wells throughout the Southwest – in all types of formations and under all well conditions.

Put Perforation Ball Sealers to work for you. Call your nearest Western office. For Engineered Well Services, Gammatron logging, jet perforating, fracturing and acidizing, next time – GO WESTERN!

WESTERN engineered

THE WESTERN COMPANY

GENERAL OFFICES: *Midland, Texas*

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Save Money

with pipe that fits your needs

Armco Pipe available in 132 different diameter-wall thickness combinations

When you install a pipe line or processing system there is no need to pay for unnecessary extra capacity, or for a heavier-wall pipe than you need. You can get Armco Pipe in 20 different diameters from 6 to 36 inches, and 10 different wall thicknesses from 9/64- to 1/2-inch. 132 different diameter-wall thickness combinations let you meet your needs without buying excess metal.

Write for Data

Write for complete data applied to your needs. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 4987 Curtis Street, Middletown, Ohio. 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

Specify Armco Welded Steel Pipe to meet requirements in the Natural Gasoline and Natural Gas Division, and wherever else you need dependable line pipe.

ARMCO WELDED STEEL PIPE

ARMCO®

In carrier landings, planes coming in at more than 100 knots are stopped in a split second. This amazing performance is made possible by having each plane hook onto one of several wire ropes stretched across the flight deck. Both plane and rope receive an almost unbelievable shock at the moment of contact. Needless to say, only top-quality wire ropes can be used for this application because . . .

you can't bargain with safety

While your use of wire rope differs from this carrier application, *safety should be just as important to you.* For, although a "bargain" rope may save you money, it can cost you your peace of mind. So don't bargain with safety. Buy a rope that's a *quality* rope—buy Wickwire Rope. 5049

WICKWIRE ROPE — A CF&I PRODUCT

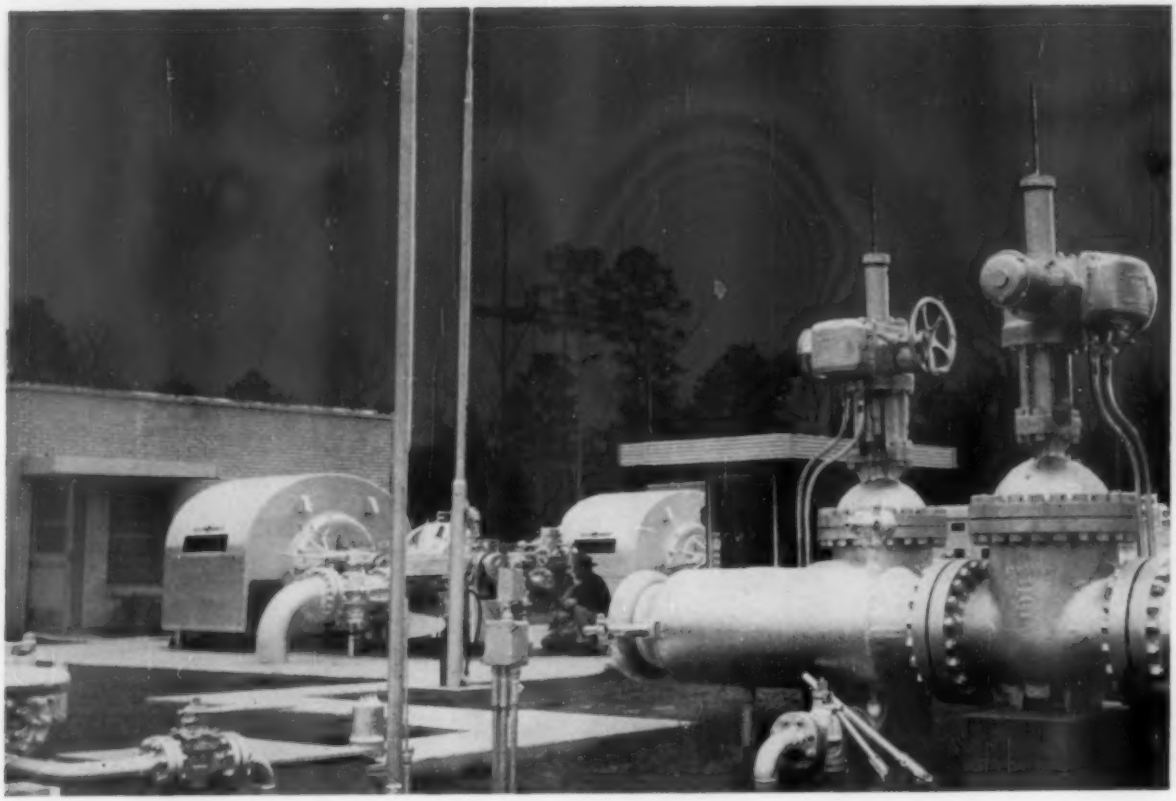
CF&I

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

LOOK FOR THE YELLOW TRIANGLE

THE COLORADO FUEL AND IRON CORPORATION—Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New Orleans
New York • Philadelphia

PIPE LINE PUMPING MAKES WONDERFUL CHANGE WITH ELECTRIC POWER



Operated by Remote Control

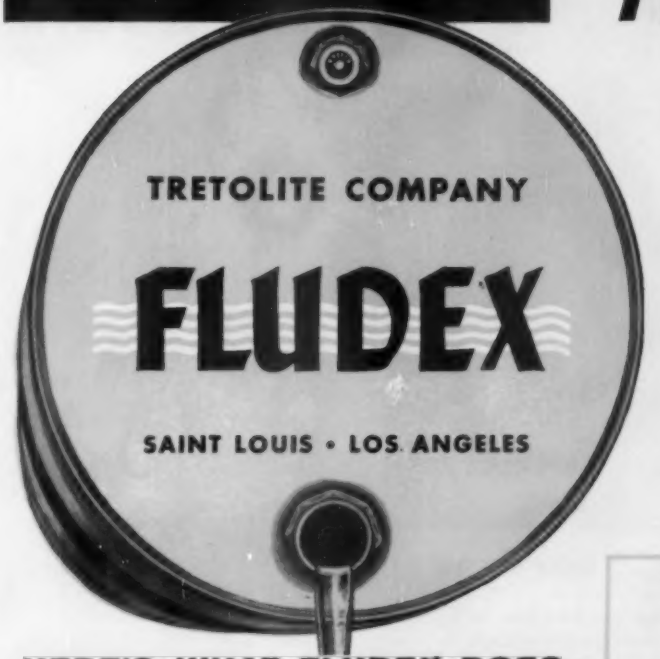
There are over 686,000 miles of pipe line throughout America today – three times the total U.S. railroad trackage. Reason for this big boom is economy of transportation. Closely linked with the economy picture is UTILITY ELECTRIC POWER – the power that has made push-button, fully automatic pipe line operation possible. When you have deliveries to make on schedule – at low cost – without the usual worries of station down-time, etc. – USE UTILITY ELECTRIC POWER. It's the sure way to be modern, more progressive and make more money.

I'M LCP – Low-Cost Power on the Job 24 Hours Daily

PETROLEUM ELECTRIC POWER ASSOCIATION

P. O. BOX 2771 DALLAS, TEXAS

NEW from TRETOLITE!



WATER FLOOD and WATER DISPOSAL STIMULATOR

enables formations to take more water... at lower pressures... in less time!

This new multipurpose chemical formulation is ideally suited for operation where combinations of scale, corrosion or bacteria are contributing to the malfunction of your flood or disposal systems.

FLUDEX HAS BEEN FIELD-PROVED!

HERE'S WHAT FLUDEX DOES ...AND HOW IT DOES IT

Makes Excellent WETTING AGENT.

FLUDEX conditions the surface of the formation so it will absorb more water more quickly at lower operating pressures.

Kills SULPHATE-REDUCING BACTERIA.

Destroys those bacteria which have the ability to reduce sulfates to hydrogen sulfide—which ultimately combines with soluble iron in the system to become insoluble, formation-plugging iron sulfide.

Inhibits CORROSION.

As a result of its bactericidal action, FLUDEX inhibits corrosion by reducing the production of corrosive hydrogen sulfide.

Aids in DEFLOCULATION OF SOLIDS.

By filming precipitates and suspended matter as soon as they are formed, FLUDEX eliminates the agglomeration of these objectionable deposits.

WRITE FOR YOUR COPY

of this new Booklet—describes the characteristics of FLUDEX, lists case histories, methods of application, etc.

TRETOLITE COMPANY

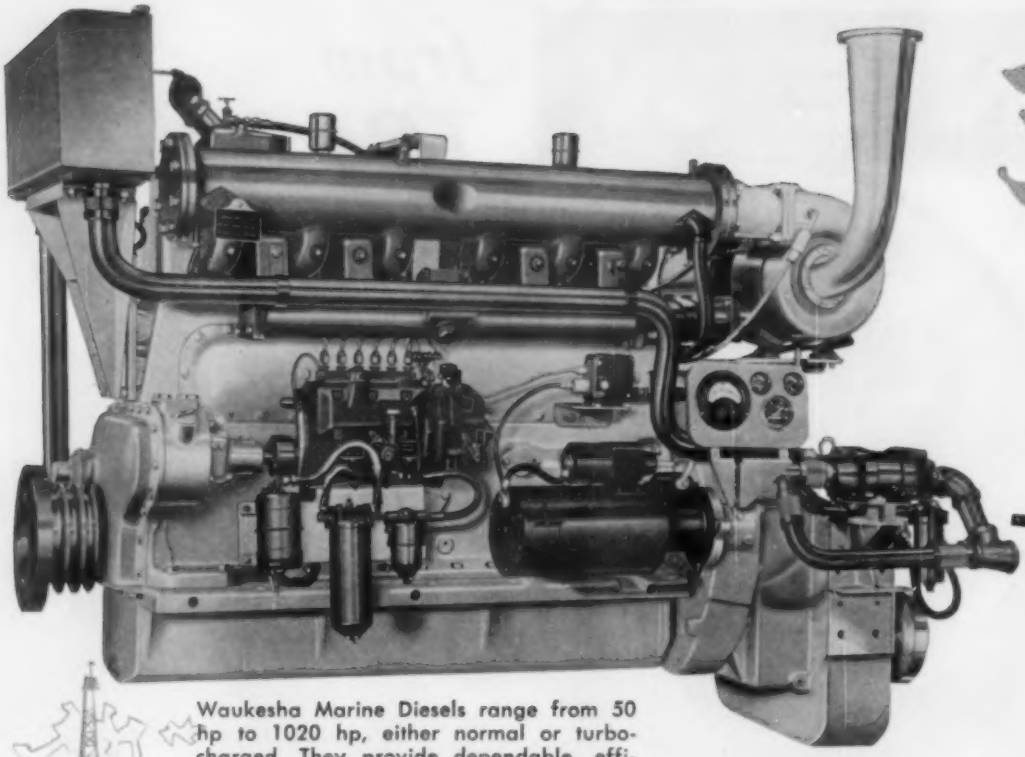
A DIVISION OF PETROLITE CORPORATION

369 Marshall Avenue, St. Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California

Chemicals and Services for the Petroleum Industry

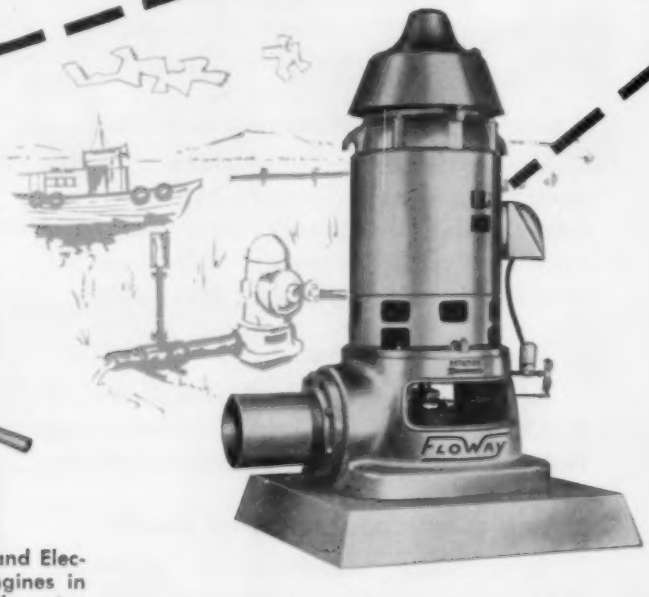
DESALTING • DEMULSIFYING • CORROSION INHIBITING • SCALE PREVENTION
FUEL OIL ADDITIVES • WATER DE-OILING • METAL DEACTIVATORS

TWF-57-4



Waukesha Marine Diesels range from 50 hp to 1020 hp, either normal or turbo-charged. They provide dependable, efficient power for crewboats and towboats in the roughest industrial service. Waukesha Marine Diesels set a new standard for safety, simplicity, smoothness and economy.

American M.A.R.C. Diesel Power Units and Electric Plants were the first air cooled engines in the U.S.A. and are leaders in the small engine field. The low maintenance cost and operating economy of American M.A.R.C. Air Cooled Diesel Engines make them ideal power plants wherever a 5-15 hp requirement exists.



FloWay Turbine Pumps are excellent for a wide variety of water applications. Basic design features and improvements over conventional pump design result in maximum efficiency and trouble free operation. FloWay Pumps are especially suited for agricultural and industrial application.

important new additions to the complete equipment line of

Waukesha Sales & Service, Inc.

WAUKESHA MARINE DIESELS

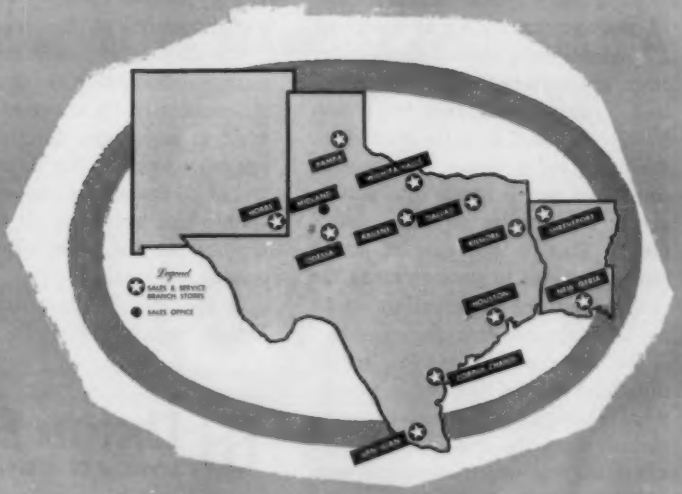
AMERICAN M·A·R·C DIESEL ENGINES

FLOWAY TURBINE PUMPS

Waukesha Sales & Service, Inc., supplies dependable power for every need: drilling, pumping, hoisting, lighting, transportation.

In addition to a full line of Waukesha Drilling Engines, Kohler Power Units and many other name brands, Waukesha Sales & Service, Inc. now announces the addition of three important products—a marine diesel engine, a small air or liquid cooled diesel engine and a turbine water pump—described on the opposite page. These products are among the finest in their fields.

Write for full information and service locations.



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Sales & Service, Inc.

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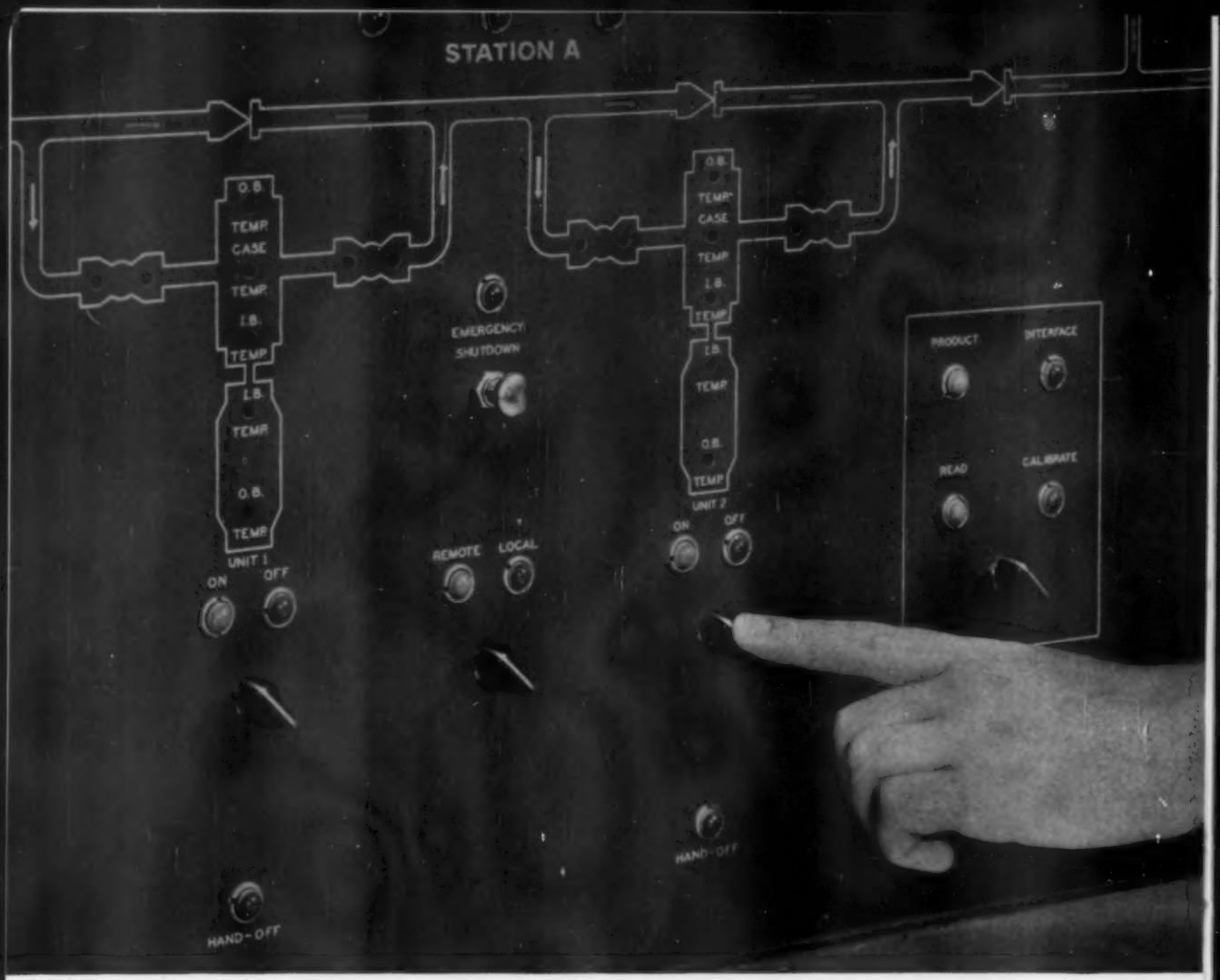
EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES



How to push a million gallons of oil from Texas to Chicago—*with one finger!*

A DISPATCHER, sitting at a control console in a central dispatching office, pushes a button—and Centralized Transport Control by Union Switch & Signal does the rest. Hundreds of miles away, a remotely controlled pump hums into action, giving the flowing oil the boost it needs. This is but one of many pumps, located in stations along the entire length of the pipeline, which are all controlled from the console.

On the control console, lighted diagrams tell the dispatcher exactly what is taking place at each pumping station along the line—which pumps are on the line, which valves are open. He can also obtain the temperature and pressures of the moving oil.

The dispatcher receives up-to-the-minute information constantly and automatically. He knows at all times what is happening throughout the entire system. He has fingertip control of all the pumps and valves that enable him to deliver oil at its destination in the most efficient and economical manner.

In the field of push-button science, Union Switch & Signal's record of achievement has been outstanding. In addition to control and communications equipment for pipelines, railways, subways, steel mills, and the mining industry, we have also designed and constructed electronic flight simulators, missile launchers, and air traffic control equipment.

We would welcome the opportunity to put our engineering knowledge and complete manufacturing facilities to work for you.

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH 18, PENNSYLVANIA

DU PONT *Petroleum Chemicals* NEWS

One of a Series of Bulletins for the Petroleum Industry

JUNE 1957

World's first TEL tank-ship commissioned

NEW ASSISTANT REGIONAL MANAGER

WILLIAM W. WINGATE was recently appointed assistant regional manager ir. the Petroleum Chemicals Division's Mid-Continent Region, with headquarters in Tulsa, Oklahoma. He replaces Barrett B. Russell, III, who has been transferred to the Gulf Coast Region in a similar capacity.

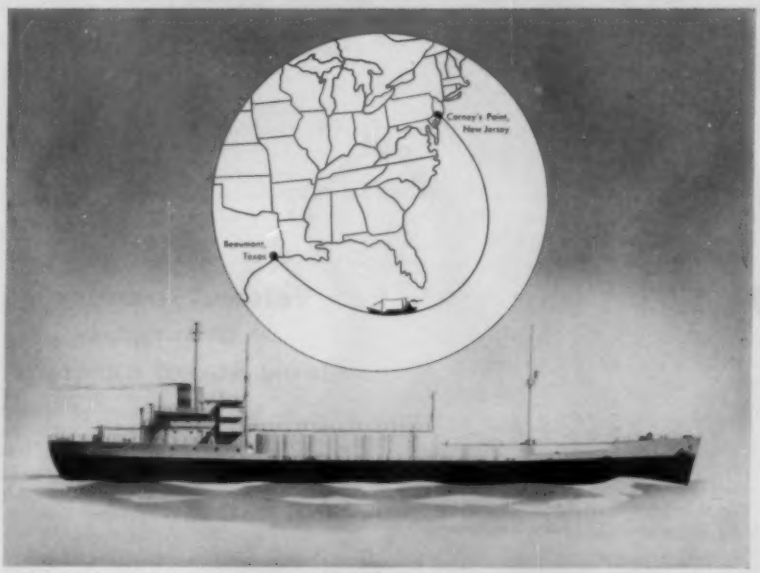
Previously Bill was active in regional sales and technical service work on all Du Pont additives other than tetraethyl lead. This includes Du Pont Estersil GT grease thickener, metal deactivators, lube and fuel oil additives, antioxidants, dyes and grease stabilizers.

Bill Wingate had an early introduction to the oil industry doing gasoline and lube oil testing for Socony-Mobil Oil Company, Inc. while earning his B.S. degree in chemical engineering at the University of Pennsylvania.

During World War II, Wingate was a lieutenant in the Navy and spent three years on submarine duty with the Pacific Fleet.

He is a member of Sigma Xi and Tau Beta Pi.

Rebuilt ship brings convenient Du Pont TEL supply to Gulf Coast refining area



MV PETROCHEM – the first chemical carrier for overwater transport of bulk shipments of TEL antiknock compounds. Rebuilt for the exclusive use of Du Pont, the 6,000-ton tank-ship was recently put into service to meet the expanding needs of Gulf Coast refiners.

SHIP-SUPPLIED STORAGE AND DELIVERY TERMINAL AT BEAUMONT COMPLETED

Another important TEL delivery convenience for Gulf Coast refiners became a reality with the recent rechristening of the MV PETROCHEM – the first TEL tank-ship. This unique ship makes possible a major source of Du Pont TEL supply right in the Gulf Coast area.

Also, TEL handling facilities have been constructed at Beaumont, Texas. These will provide dock accommodations for the new ship, and storage and distribution facilities for its cargo. Thus, the Beaumont terminal is equipped to provide the same TEL-availability and delivery service as Du Pont's manufacturing plants at Carney's Point, New Jersey and Antioch, California.

Bulk shipments

MV PETROCHEM'S maiden voyage marked the first time tetraethyl lead compounds have been transported over water in bulk. To accomplish this safely, the tanker was redesigned and rebuilt, from the hull up, to rigid Du Pont specifica-

OVER

DUPONT *Petroleum Chemicals* NEWS

Diesel locomotive fuel problem solved with Du Pont additive

R. R. SHOP SUPERINTENDENT:
Incompatible economy diesel fuels are causing injector-sticking and filter-plugging that cost us plenty in time and money.

OIL SALESMAN:
We've been hearing that lately. Incompatibility *is* the problem – but there's a way to solve it. I'll tell the refinery about it.

REFINERY EXECUTIVE:
Yes, I've been reading your ads telling how Du Pont's FOA-2 helps eliminate most diesel fuel incompatibility troubles. What about it?

DU PONT REPRESENTATIVE:
That's right, it does! Here, let me show you our data. I'll show your customer, too.

R. R. SHOP SUPERINTENDENT:
This injector's clean as a whistle—and it's been in operation 35 days.

DU PONT REPRESENTATIVE:
In most cases Du Pont FOA-2 keeps fuel oils gum-free. And while it helps prevent injector-sticking, filter-plugging it does not contribute to sparking tendency, because it burns without ash.

CONTINUED

Tanker shipments

tions—so rigid, in fact, that the PETROCHEM meets or exceeds the requirements of any port authority in the world!

TEL to Texas – raw materials back

The converted ship is in reality a two-cargo vessel. Designed primarily to move bulk shipments of TEL south from Carney's Point, it is also equipped with separate tanks for transporting ethyl chloride and ethylene dichloride back to Carney's Point.

Safety for crew and cargo

The PETROCHEM is permanently compartmented, with solid bulkheads dividing the operational and cargo sections. Still other solid bulkheads – welded to the hull itself—separate each of three cargo spaces. Safety and product cleanliness were the primary design considerations.

Unique features

Many new safety features were specially designed for this 6,000-ton tankship. Each compartment is ventilated separately by a system which effects a complete change of air throughout the entire ship every three minutes. A vacuum system is another of the many special facilities for safe maintenance, repair, and product handling.

If you operate a refinery in the Gulf Coast area, the new ship and terminal are your assurance of a nearby ample supply of Du Pont TEL.

Voice of America to broadcast Magic Barrel excerpts

Parts of the oil industry's "Magic Barrel" presentation have been recorded for broadcasting to people behind the iron and bamboo curtains as well as in free countries of the world.

Members of the Voice of America staff first became acquainted with the Du Pont-designed Magic Barrel when visiting the company to develop a special program using the voices of approximately 100 foreign-born and native American Du Pont employees. At this time, the Magic Barrel was shown to the Voice staff to acquaint them with the group of Du Pont products made from oil. They saw in this presentation some of the fruits of American enterprise – presented in a dramatic and convincing fashion. So they asked to have parts of it taped for broadcasting to their listeners.

The Magic Barrel broadcast has been included in a more comprehensive program in 32 languages under the title, "The People's Capitalism."

This program will also explain the widespread sharing of benefits under the American economic system and tell some of the history of the Du Pont Company. Recorded interviews with employees who emigrated from 44 foreign countries will appear on the program, along with company executives, scientists and union representatives. The interviews were all spontaneous . . . no prepared scripts.

The Voice of America program is the first concerted effort to tell the story of an American company in many languages.

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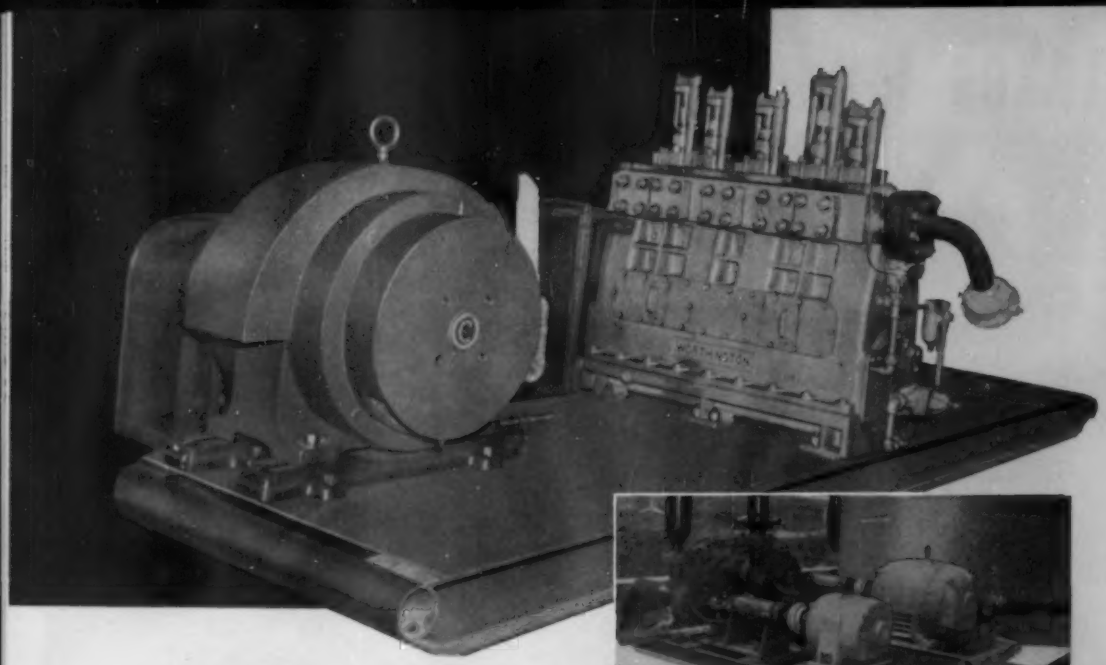

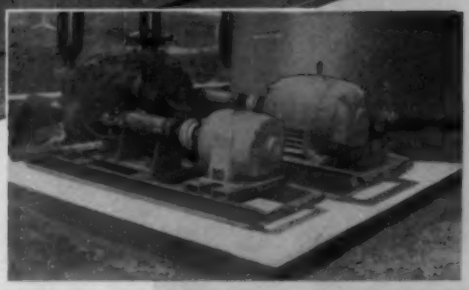

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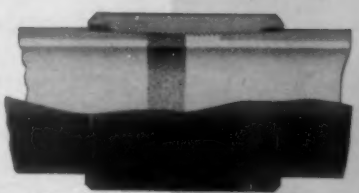
Water flooding goes more smoothly wherever J&L Supply is called in to provide key equipment and stand by with 24-hour service.

Supplies? Yes. Rotary rigs and cable tools; J&L tubular goods including *Mill Lined* cement lined pipe; valves, fittings, meters, controls, pumps, motors, engines, feeders, tanks, filters — that sort of thing.

But we're equipped and qualified to go farther than that. The business, for instance, of carefully engineered and tailored circulating, backwash and injection pump units, skid-mounted and ready — units especially designed to do the job you want done and do it smoothly.

Let's talk about this vitally important service — your engineers with ours, or we'll shoulder the whole load and come up with recommendations. A call right now to any J&L number will trigger know-how and resources you'll be glad you discovered.



Coupling with J&L CEMENT LINING

You can have J&L Supply custom-design and tailor-make a skid-mounted pump unit for ANY oil country application. Components, available from practically all leading manufacturers in case you have brand preferences, include rotary, centrifugal, piston, plunger and vacuum pumps; gas, gasoline and diesel engines; electric motors. This highly satisfactory J&L custom service includes vacuum, compressor, and generator units, and gas volume tanks.

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SUPPLY DIVISION – Tulsa

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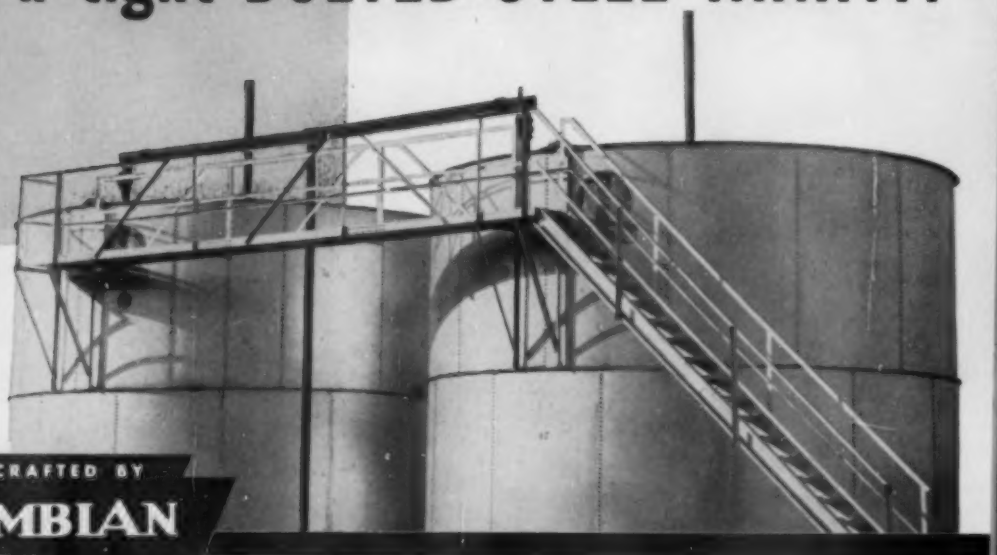

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STEEL, Master-Crafted by Columbian... First for Lasting Strength

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They Say—

Imports no cause for alarm

"We believe that voluntary cooperation by the importing companies has worked better than its critics admit.

"Those who oppose imports are inclined to quote figures applying to the whole of the United States, disregarding the fact that our Pacific Coast area cannot produce enough oil for its needs.

"Furthermore, Canada, from which some oil is imported, is a logical source for U.S. areas both west and east of the Rockies. Canada is so closely tied to our economy that one inclines to regard it as an integral part of our U.S. oil supply picture. Venezuela and the other Latin American nations are only slightly less so.

"Granting that there are varying views of this matter, the facts suggest that there is no real cause for alarm. Total crude-oil imports into the U.S. as a whole as planned by the importing companies during the second half of this year amount to 1,261,000 bbl. a day. If Pacific Coast imports are excluded, the rest of the country will import 943,000 bbl. a day of which 59,000 will be from Canada, 571,000 from Latin America, and 313,000 bbl. a day from the Middle East. All of these figures must be viewed in relation to total 1957 demand for crude in the U.S., estimated at 8,200,000 bbl. a day, of which 7,000,000 is east of the Rockies."

B. Brewster Jennings, chairman of the board, Socony Mobil Oil Co., Inc., in a statement at the annual shareholders meeting.

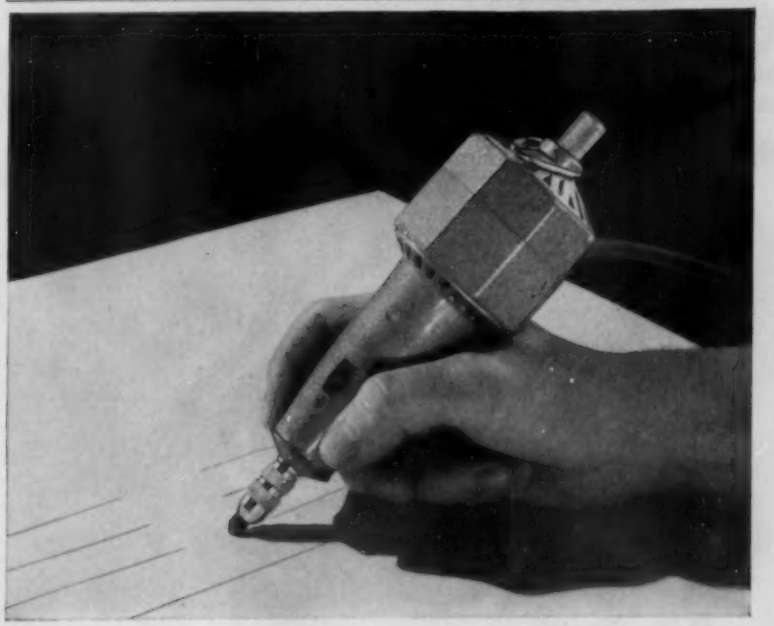
Top Kansas field is 41

"Most remarkable achievement of the famed El Dorado oil field lies in the fact that, after 41 years of brilliant performance, it came back in 1956 to lead all the other fields of Kansas.

"For a solid 20 years, in the period 1915-35, the El Dorado oil field's output kept Butler County in the position of the number one oil-producing area of Kansas. Now, after an interval of more than 4 decades, the field tops all rivals again. Its closest competitor in this respect is the prolific Trapp field of Russell and Barton counties—and the El Dorado 'grandaddy' with an output of 4.35 million barrels led that area last year by a margin of more than 117,000 barrels.

"The smashing success of secondary-recovery operations by water flooding, conducted by Cities Service Oil Co.

DRAFTING TRENDS



New erasing machine for fast, clean, effortless erasures

The idea of erasing machines certainly is not new. However, it wasn't until the Sovereign was developed that so many time-saving and drafting efficiency features were combined into one product.

Distributed by POST, the smooth-running, light weight Sovereign erasing machine can be used as accurately and effortlessly as a pencil point. Even for fine lines, just a dab with an easy-to-handle Sovereign gives a clean, neat erasure without damage to the drawing.

The speed of the rapidly rotating eraser does the work, not pressure. In fact, if too much pressure is used, the machine automatically stalls, thereby safeguarding your drawing. Operation is cool, as the Sovereign definitely will not overheat.

Using a Sovereign is just as easy as reaching for an old fashioned eraser . . . and much more convenient. Curved to fit the hand, it incorporates many design features of special appeal to engineers and draftsmen. For example, the hollow armature shaft takes a full 7" core eraser which feeds through an instantly adjustable chuck. The extra long eraser eliminates those frequent, annoying changes often associated with ordinary erasing machines using short erasers. (When a change is finally made, the chuck cuts replacement time to *less than 10 seconds.*)

The large loop hanger is ideal for hanging the Sovereign within easy reach of the board. Or, if the erasing machine is used frequently, the octagonal shape design permits the draftsman to lay it on the drawing board without fear of it rolling off.

For more information on the Sovereign Erasing Machine, see your POST dealer or write to the Reader Service Division of the Frederick Post Company, 3644 N. Avondale Ave., Chicago 18, Illinois.

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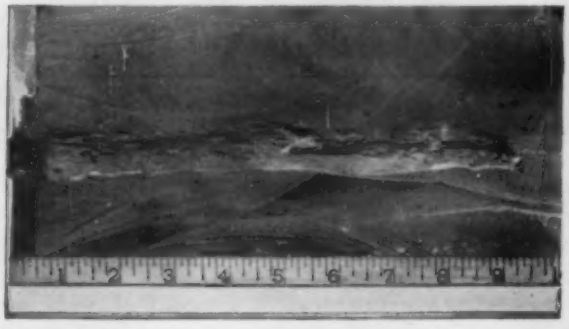
Shooting Tests

From the test results shown here, it is evident that the 2⅛" Capsule-Jet can be utilized in all types of well completions requiring a shaped charge perforator.



Penetrations, as shown and described in both the target and the illustration, were obtained in cured neat cement.

CAPSULE-JET PERFORATIONS HAVE A HIGH FLOW RATE

The introduction of the expendable perforator by Schlumberger in 1951 opened an entirely new field of well completion practices. From the research and engineering laboratories of Schlumberger, now comes the latest and best in shaped-charge perforators . . . the New Capsule-Jet.

The Capsule-Jet is a thru-tubing expendable perforator in two sizes, 2⅛" and 1-11/16". The design features four or five shots per foot, phased at 90°.

This gun gives greater penetration than any thru-tubing perforator on the market and equals that achieved with the larger 4-inch carriers. The Capsule-Jet is designed to give its maximum formation penetration irrespective of the gun's position in casings up to 7½". This feature is important since the gun generally fires while lying on one side of the pipe.

The Capsule-Jet Perforator gives large, uniform holes to maximum penetration . . . holes that are even larger than the casing holes. The very shape of this perforation practically eliminates plugging—with either remnants of the charge or pulverized sand.

The new Capsule-Jet—with its deep penetration, large casing hole and large uniform formation hole—makes a perforation with superior flow characteristics, proved beyond any doubt in Schlumberger's high-pressure, temperature and flow laboratories.

Write for complete details or ask your Schlumberger engineer to give you additional information on *the best and most powerful thru-tubing gun in the field today!*

SCHLUMBERGER WELL SURVEYING CORPORATION

Schlumberger . . . Engineering for Better Service.

Prove Superior Charge Design

The NEW Schlumberger CAPSULE-JET PERFORATOR

For deep effective perforations that have a high flow index . . .
USE THE SCHLUMBERGER CAPSULE-JET

Check these other outstanding features . . .

Designed to give maximum formation penetration regardless of gun's position in the pipe.

Breaks up into small pieces, and will not obstruct further runs.

It leaves a minimum of debris—The debris from one foot of gun will fill only *one inch* of 5½" casing.

It is extremely flexible . . . allows easy handling of long sections of guns . . . will pass through kinks in the tubing.

It can be assembled with blank spacers to facilitate spacing of shots.

100 feet or 400 shots can be run on one trip in the well.

It can be run in pressures up to 12,500 p.s.i. and temperatures of 325°F.

It leaves no slug or debris in the perforation.

MINIMUM OF DEBRIS

The Capsule-Jet leaves a minimum of debris — just one-half the amount of the tubular guns. The capsule charge cases are made of a special die cast aluminum alloy developed by Schlumberger. The high strength and extremely low ductility of this alloy result in a case which withstands high pressures and has excellent break-up characteristics. The debris from this gun may be dissolved with the same ease as regular aluminum alloys.

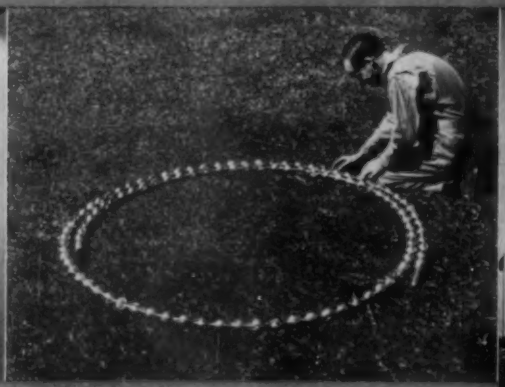
MAXIMUM FLEXIBILITY

The Capsule-Jet is designed with a minimum flexing radius of three feet. This flexibility allows the tool to be run through crooked or cork-screwed tubing without difficulties. Even though this tool is designed for maximum flexibility, charge case linkages are built for strength and durability. They will withstand a pull of 1000 lbs. without shearing.

LENGTHS UP TO 100 FEET

The Capsule-Jet gun can be run in lengths up to 100 feet. The flexibility of this gun will allow long sections to be fed into the riser assembly without the necessity of having to install a high mast or derrick on the well.

The debris from a 13-foot gun (52 charges) recovered from a well in Lea County, New Mexico. Two charges are shown for comparison.



Gun curved into a 3' flexing radius.

Capsule-Jet being fed into riser from the working platform of a portable derrick.

Why CONTINENTAL-EMSCO SWIVEL JOINTS save you money!

Service it without removing from the line

No expensive return to factory for repair

Longer life...

THE CONTINENTAL-EMSCO SWIVEL JOINT BREAKS LIKE A UNION

Within a few minutes you can inspect and service Continental-Emsco Ball Bearing Swivel Joints. Simply break the joint as you would a pipe union. Packing is then readily accessible and easily replaced if necessary. This is vitally important to the field man and reduces maintenance costs. With Continental-Emsco you can count on free easy turning and years of economical service life.

Continental-Emsco Swivel Joints are manufactured in all popular sizes for practically every type of service; from high vacuum to pressures of 15,000 psi, and from sub-zero temperatures to 750°F. Simply tell us your application and type of end connections required. When you buy a Swivel Joint, specify CONTINENTAL-EMSCO.

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CONTINENTAL-EMSCO COMPANY

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and others, is mainly responsible for this tremendous 1956 accomplishment.

"Here is an industrial exploit in which El Dorado and the Kingdom of Butler can take the most glowing pride and satisfaction."

Editorial in the El Dorado, Kans., Times.

Jersey Standard forecasts...

"We think by 1975 world energy consumption will have risen more than 70 per cent over today's total. Even allowing for the fullest contribution by nuclear energy to this future total, the major share of the expected growth will fall to natural gas and oil.

"On a world-wide basis, oil will probably be making up about 47 per cent of the total energy supply by that time, which means an increase in world oil consumption from today's 15 million barrels daily to about 32 million barrels a day by 1975, or more than double today's output."

M. J. Rathbone, president, Standard Oil Co. (N.J.), in a statement at the annual stockholders meeting.

A new deal for Oklahoma?

"It is the opinion of the board of directors of the Oklahoma Independent Petroleum Association that the present rules of the Oklahoma Corporation Commission should be brought up to date or a new set of rules, based on the present ones, be established.

"There is no doubt that the present staff of the conservation department is inadequate to enforce properly the present rules and any addition would be useless unless funds are made available for them to be enforced."

Oklahoma Independent Petroleum Association in a statement to Massena B. Murray, director of conservation, Oklahoma Corporation Commission.

Gas prices under regulation

"It has been argued that prices should be based on the cost of present reserves, and when new reserves are discovered, a readjustment of prices based on new discoveries should be made. This will not create a desire on the part of risk capital to wildcat and discover new reserves due to the hazards encountered and the uncertainty of this type of industry.

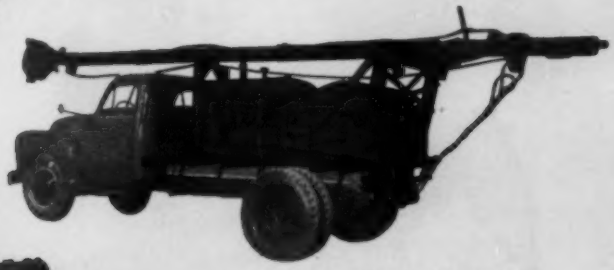
"In other words, an independent producer may take a certain amount of his current capital and set it aside to replenish his stock of goods (gas), but when he finds himself depleting his capital structure due to the costlier acquisition cost of leases, higher drilling costs due to deeper drilling, and hazardous conditions of higher pressures,

from the Shallowest to the Deepest

COOPER

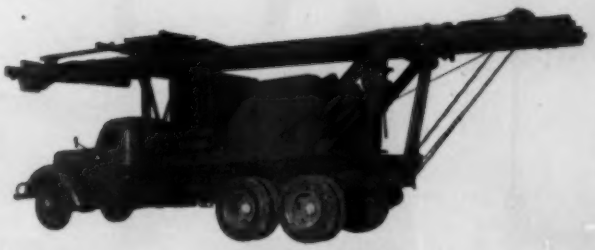
Servicing and Workover Units

MODEL "B" SKID WINCHES
for servicing to 2,000 ft. of 2" tubing

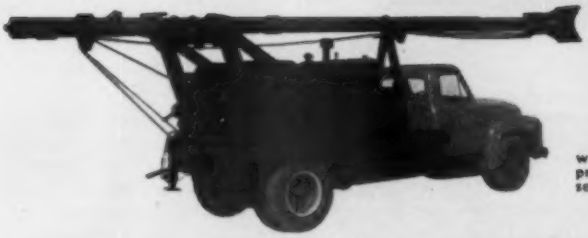


MODEL "W" SERVICING WINCHES
for servicing to 3,500 ft. of 2½" tubing

MODEL "A" SERVICING WINCHES
with friction clutches. Four sizes with proper brake capacity and power for servicing from 4,500 ft. to 10,000 ft.



TORQUMATIC "420" AND
TORQMATIC "520"
servicing and rotary workover units. Have torque converter and full torque shifting transmissions — to 300 h.p.



MODEL "P" SERVICING WINCHES
with positive clutches. Three sizes with proper brake capacity and power for servicing from 3,500 ft. to 8,000 ft.

If you prefer separate engine units for servicing and workover jobs to 10,000 ft. there's bound to be the right one for your work among the many models and sizes built by COOPER.

And, you can equip it to suit your needs from standard extra equipment: Single and two pole telescoping pipe masts or telescoping fabricated masts, racking boards, rod hangers, sand line sheaves, drum dividers, rotary drives, catheads, jerk line spudders, etc.

Cooper builds the most complete line of separate engine winches . . . there's a size and type to handle any depth well or field condition.

Originator of Mobile Winch Units

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You can make more oil for every dollar invested when CABOT pumping units are working for you!

CABOT builds a pumping unit that's specially designed for top production performance round-the-clock, month after month — unmatched when it comes to cost of operation — and, barrels of oil pumped.

Whether you specify the adjustable crank or beam-balanced series of CABOT pumping units, you'll soon see the increased values of production, durability and serviceability.

See your J & L Supply Man.

OIL FIELD PUMPING EQUIPMENT
CABOT
PUMPS, INC.
PAMPA, TEXAS
FRANKS
DIVISION OF CABOT

etc., he will retrench and slow down because he does not know what his price will be under a regulated economy even if he does make a discovery."

Arch H. Rowan, Fort Worth independent and chairman of the gas committee of Texas Independent Producers and Royalty Owners Association, in a speech at TIPRO's annual meeting, Galveston, Tex.

Substitute for foreign aid

"While the outflow of American capital each year is substantial, is it as great as it could be? I think not. There is no doubt in my mind that the uniquely productive United States economy could put three or four times as much into development of overseas enterprises as it is currently doing.

"Such enlarged participation by American corporations in overseas investment would be desirable for a number of reasons. One obvious reason is that the more private investment we have, the less we need to spend for government foreign aid programs."

T. S. Petersen, president, Standard Oil Co. of California, in a speech before the Dallas chapter, Society for Advancement of Management.

Management sets climate

"Proper, fair, and equitable decisions cannot be expected to thrive in a prejudiced or closed minded industrial climate. Management receives from its employes a reflection of whatever attitude it exhibits towards them. An attitude of confidence, trustworthiness and a cooperatively demonstrated desire to achieve common objectives, which stems from management, become reflected in kind from the employes. The opposite is equally true. Through the long industrial season, the organization 'climate' is established by management's attitude, not by the employe group . . .

"Good and adequate compensation is a very important factor in work satisfaction but . . . it does not hold the place of first importance in the minds of management personnel."

Fred E. Harrell, Curtis-Wright Corp., in a speech before the eastern district meeting of American Institute of Electrical Engineers.

Security in imports?

"Just how can too much oil be a security threat? The argument supporting this view is an old one, being espoused for years by mainly 'independent' oil producers. Independent in this case means companies which do not have foreign oil wells. These com-

"I LIKE NATIONAL TORQUE CONVERTERS BECAUSE..."

*Trip time near bottom of hole will

got a lot of answers from rig users . . . and all of them were good!

Here's why some superintendents, owners, tool pushers and chief mechanics said they liked and used National Torque Converters:

- *"Speed is faster—torque converters don't let heavy loads lug down the engines . . ."
- *"Rotary table starts smoother and is softer on drilling operations . . ."
- *"Builds up more pressure and moves more fluid than any other drive . . ."
- *"Trip time near bottom of hole will average 45 minutes faster with converters . . ."
- *"Engines last about twice as long between major overhauls—20,000 hours or more . . ."
- *"More ton miles from drilling line" . . . "clutches last longer and require less maintenance . . ."

*Actual statement of owner or operator who has used National Torque Converters.

It all adds up to *more* hole *faster*—with *less* strain on operator and equipment, *more* useful work between overhauls, *less* dollars for maintenance and replacement. If these are advantages you have been looking for, remember you get National Torque Converters in a full range of "mated" capacities to handle anything from 100 to 1000 hp—or obtain them "packaged" with the prime movers of 16 of the nation's leading engine builders . . . or specify them on new rigs purchased from any of 10 major rig manufacturers. Information? Write:

THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

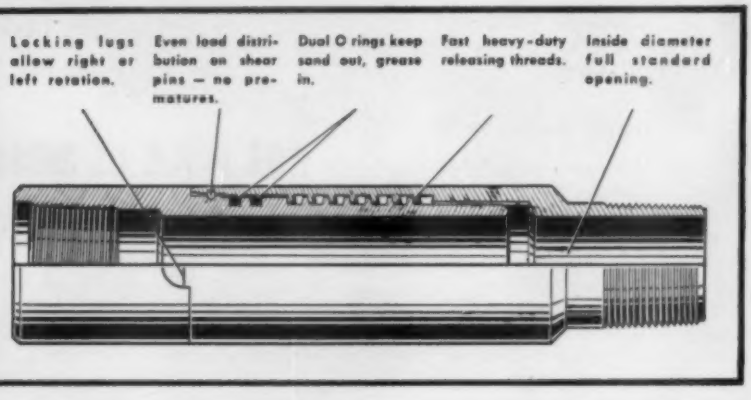
Two Gateway Center, Pittsburgh 22, Pa.

Pace-setters in the progress of industrial power transmission

BETTER BE SAFE THAN SORRY!

GUIBERSON *Type A* SAFETY JOINT

This tubing safety joint gives you positive protection under any well condition. It releases quickly — but *only* when you're ready. Shear pins support only the weight *below* the joint, so you can depend upon them to shear with the *correct tubing pull* at the joint. Available in 16,000, 22,000 and 30,000 lb. shear point strengths, with right or left hand release. For the kind of protection that keeps you safe, instead of sorry, depend upon the best — Guiberson.


Locking lugs allow right or left rotation.
Even load distribution on shear pins — no prematures.
Dual O rings keep sand out, grease in.
Fast heavy-duty releasing threads.
Inside diameter full standard opening.

Back-Off Safety Joints — Guiberson has two types of back-off safety joints — Type B and Heavy-Duty Type F. Both are available with either right or left hand release and both are modestly priced.

THE
GUIBERSON
CORPORATION
ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.
Sold by
Oil Field Supply Stores
Everywhere

panies say that if foreign oil floods into the U.S., depressing prices, there will be less, or no, incentive for new oil fields to be sought in the U.S. And this could lead to a bad supply situation in any war.

"Doubtless things could work out this way. But if we need oil for war and there's a chance of it running out the best guarantee would seem to be to use as much foreign oil as we can.

"The independent oil men are certainly entitled to make their argument. But we do wonder about the tendency to wrap every argument in the flag."

Editorial in the Wall Street Journal.

No liquid fuel substitute

"There does not seem to be anything on the technological horizon to indicate that we are going to find a usable substitute for liquid fuels of a non-liquid nature. That is to say, atomic energy or the use of solid fuels such as coal hold no technical promise for the automotive industry."

Donald Frey, director of engineering, Ford Motor Co.

CALENDAR OF EVENTS

JUNE

10-12 Interstate Oil Compact Commission midyear meeting, Yellowstone National Park.

10-14 Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

12-14 Engineering Institute of Canada, annual meeting, Banff, Alta.

16-21 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

17-21 Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

18-19 Rocky Mountain Oil and Gas Association, annual meeting of refining committee, Northern Hotel, Billings, Mont.

19-21 Association for Computing Machinery, twelfth annual meeting, University of Houston, Houston.

20-21 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.

20-22 Intermountain Association of Petroleum Geologists, eighth annual field conference, Uinta Basin.

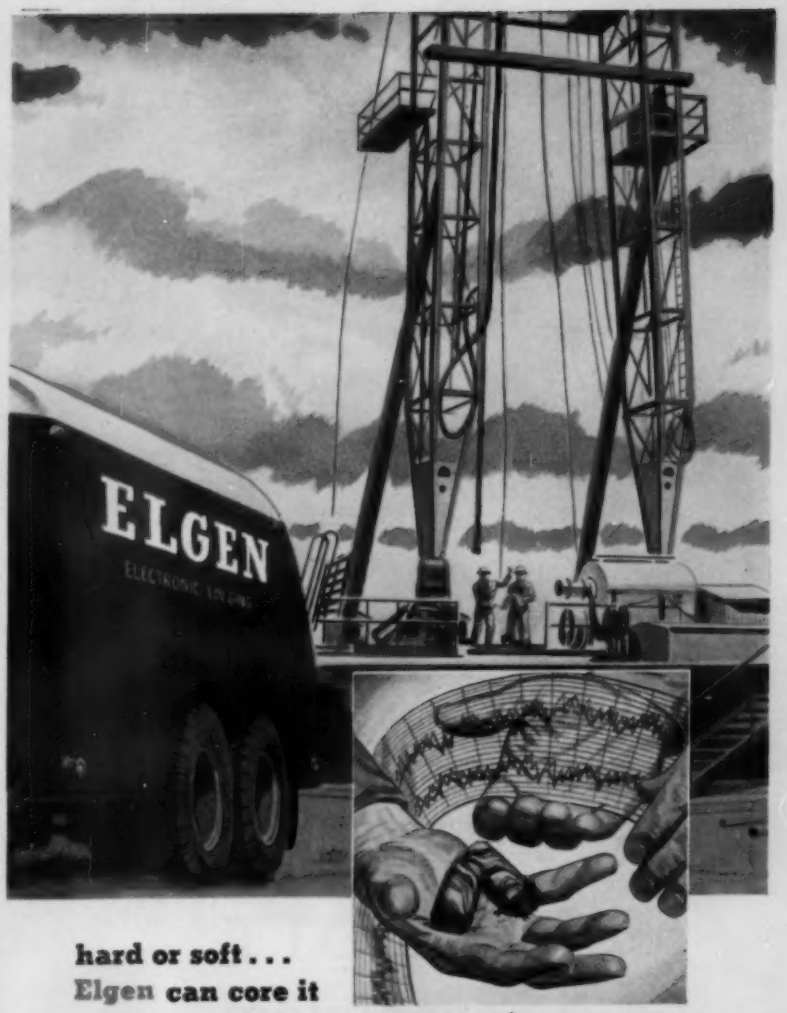
20-22 National Oil Scouts and Landmen's Association, annual meeting, Hotel Cosmopolitan, Denver.

23-27 Canadian Gas Association, Jasper Park Lodge, Jasper, Alta.

26-29 American Association of Cost Engineers, first national meeting, University of New Hampshire, Durham, N. H.

JULY

8-19 Industrial Statistics for the Process Industries, second annual conference, sponsored by American Society for Quality Control and the University of



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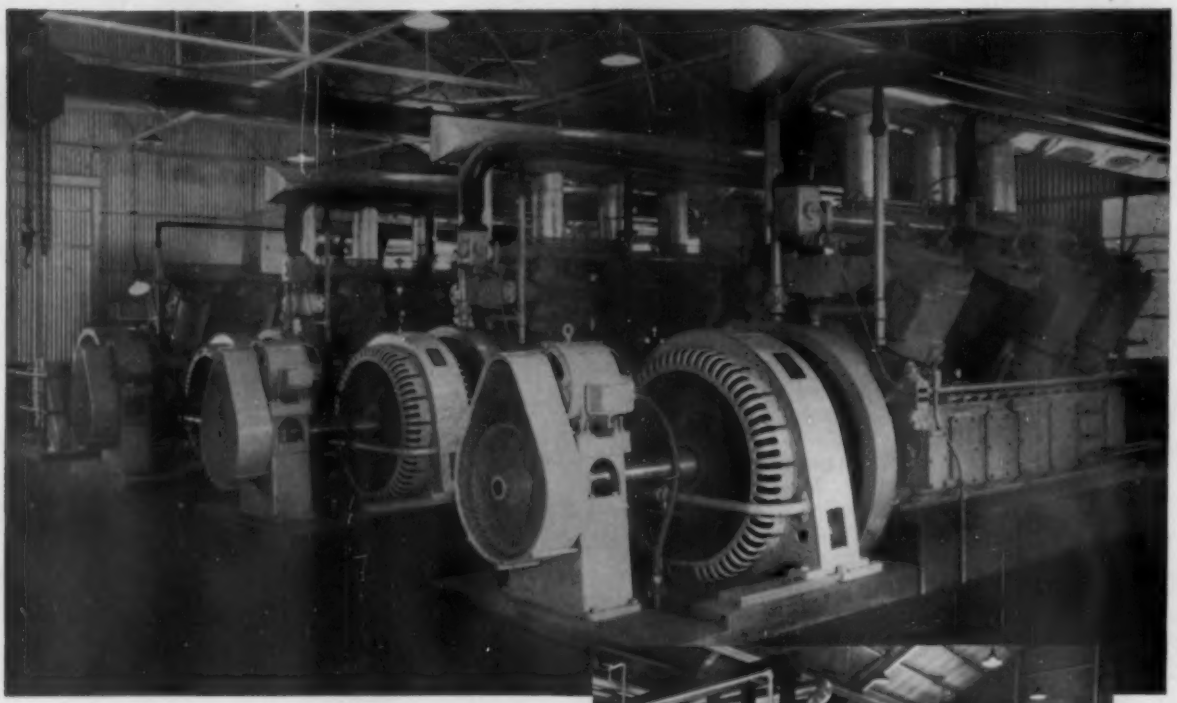

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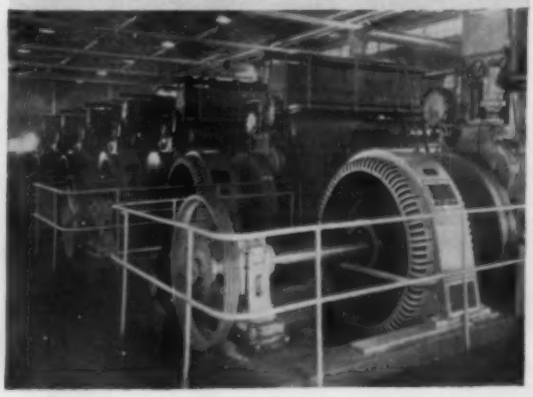

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R7-8

Oklahoma, Lockett Hotel, Norman, Okla.

AUGUST

1-3 Rocky Mountain Mineral Law Foundation, third annual institute, Montana State University, Missoula, Mont.

19-20 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

26-28 Seventeenth annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

28-30 Instrument Society of America, International Symposium on gas chromatography, Kellogg Center, Michigan State University, East Lansing, Mich.

SEPTEMBER

3-5 Pacific Coast Gas Association convention, Fairmont and Mark Hopkins Hotels, San Francisco.

5-7 New Mexico Geological Society, eighth annual field conference, southwestern Colorado.

8-13 American Chemical Society, 132nd national meeting, New York City.

9-10 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

11-13 National Petroleum Association, fifty-fifth annual meeting, Traymore Hotel, Atlantic City, N. J.

19-21 Rocky Mountain Oil Show, fairgrounds, Casper, Wyo.

22-25 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Mayo Hotel, Tulsa.

26-27 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

26-27 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, Roosevelt Hotel, New Orleans.

30-Oct. 2 American Oil Chemists' Society, 1957 fall meeting, Netherland Plaza Hotel, Cincinnati.

OCTOBER

1-2 Texas Mid-Continent Oil and Gas Association, thirty-eighth annual meeting, Texas Hotel, Fort Worth.

2-4 Golden Trend Oil Show, Pauls Valley, Okla.

6-9 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fall meeting, Adolphus, Baker, and Statler Hilton Hotels, Dallas.

7-9 American Gas Association, annual convention, Kiel Auditorium, St. Louis.

7-11 American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago.

13-15 American Association of Oilwell Drilling Contractors, seventeenth annual meeting, Mayo Hotel, Tulsa.

13-19 OIL PROGRESS WEEK.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southern California petroleum section, fall meeting, Biltmore Hotel, Los Angeles.

17-19 Four Corners Geological Society, second field conference, Gallup, N. M.

20-22 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Peabody, Memphis.

24-25 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

27-29 Independent Petroleum Association of America, annual membership meeting, Statler Hilton Hotel, Dallas.

31-Nov. 1 American Association of Petroleum Geologists, Mid-Continent regional meeting, Cimarron Ballroom, Tulsa.

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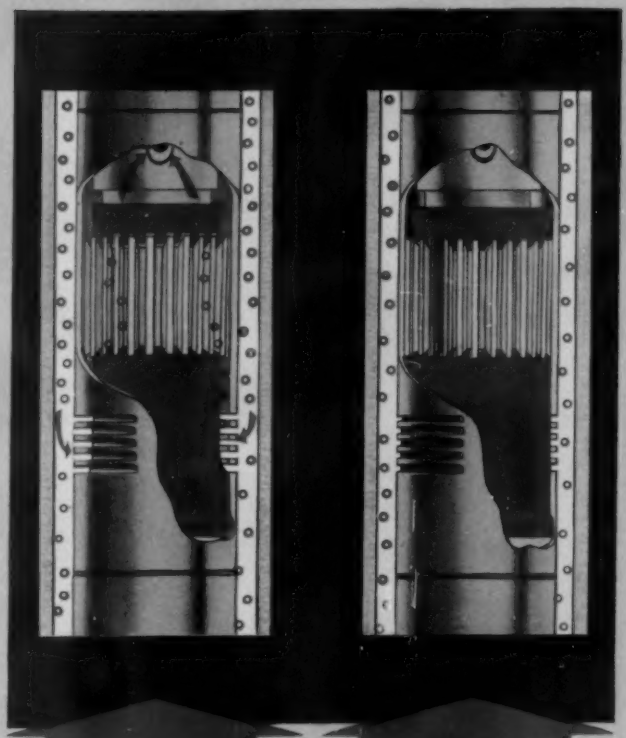

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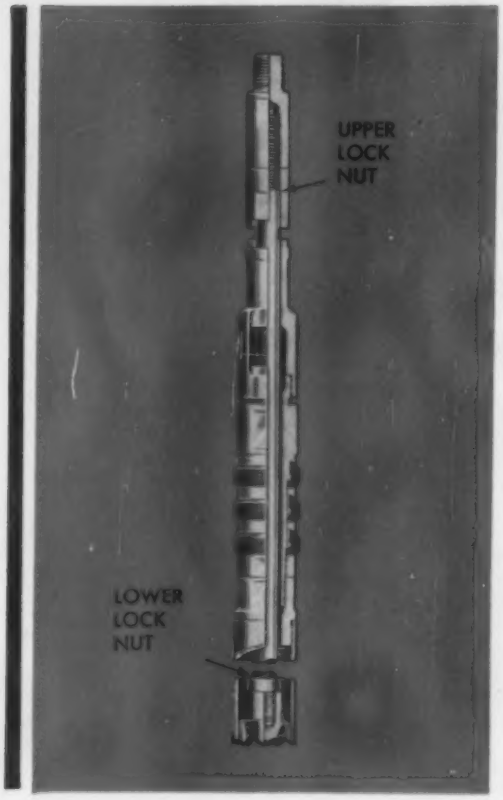

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P702

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Possum Kingdom

SOME 100 miles west of Fort Worth is an area that belies the popular conception that West Texas is nothing but a vast featureless, treeless plain. It is hilly, wooded, and (at least this spring) laced with brimming streams. It abounds with native wildlife, particularly opossums, which has given the area the name of Possum Kingdom.

A couple of weeks ago it buzzed with another form of native wildlife—independent oil producers. And they weren't playing possum, either. They were wide awake, and they were angry. They were gathered for an annual conclave and fish fry on the shores of beautiful Possum Kingdom Lake. But they weren't much interested in scenery or fish.

Texas oil producers are usually a pretty cheerful and optimistic bunch. But at this gathering the pessimism in the air was more pungent than the odor of the barbecue. These men think the oil business is going to hell in a handcar.

They blame importers, major companies, and Eisenhower—in that order.

They complain that drilling is down, costs are up, money is tight, and nobody seems to want to buy any Texas crude oil. And few of them profess much hope that things are going to get any better in the foreseeable future.

The picnic was held during a particularly bad week for the independents. The Railroad Commission had just announced that Texas production would be cut to 15 days during June. Figures had just been released indicating that imports of foreign crude oil are going to increase fast and reach new heights in coming months. Major companies were announcing a 6 per cent increase in wages and salaries, and the independents would have to follow the pattern. A rumor was going around that the price of oil-country tubular goods and other steel items would be advanced in July.

The cloudbursts in many parts of Texas had caused damage and greatly hampered operations. The floods had shut down rigs, closed roads, and kept oil from being trucked to pipelines. Pipelines were refusing to extend gathering lines to several thousand unconnected wells. Some purchaser proration was appearing, and there was talk of much more. And in Washington a White House spokesman had just torpedoed the natural-gas bill.

The 25-cent increase in crude prices last January, which raised such an outcry in Congress, didn't cover recent increases in producing costs, they say, and many fear that this increase won't stick. "If imports aren't cut we're going to have to give back our two bits," said one.

They blame imports for most of their troubles, and what some of them would do to importers shouldn't happen to a dog. They don't think Eisenhower is going to do anything that will reduce imports materially, feel that his recently announced study is just a stall.

One producer tried to muster recruits for a mass march on Washington, to camp in the Mall until action is taken. "We're going to see Texas allowables cut to 10 days a month by fall unless imports are limited," predicted another.

"Blaming imports is an oversimplification," said one thoughtful producer quietly. "Producers and drilling contractors are being hurt by a good many other factors, such as bad weather, tight credit conditions, and rising costs, which have no relation to imports. But the flood of imports is certainly a major threat."

And one old-timer observed: "Things will work out eventually. I've seen conditions just as bad many times. I figure it will take the industry about 18 months to work itself out of the present mess. Then things will look better for domestic producers again."

He may be right. But a lot of those independents think that things are going to get a lot worse before they start getting any better, and that they will all be flat busted long before 18 months.

And if the importers, major companies, and the Republican National Committee had had spies at the Possum Kingdom picnic their ears would have burned plenty. Those Texas independents are plumb mad at all of them.

—Henry D. Ralph.

automation underground

THE VARIABLE VALVE in Baker Differential FILL-UP Equipment is an amazing example of "down-hole" AUTOMATION. As a string of casing is lowered in the well, this valve AUTOMATICALLY takes into account the *weight and viscosity of the mud;* the *rate of lowering;* the *hydrostatic head* in the casing and in the annulus; and the *pressures* which tend to build up ahead of the descending, piston-like string of casing. Then, having *instantly* computed ALL these factors, the Variable Valve opens just enough to prevent pressure-surge build-up by permitting the casing to fill AUTOMATICALLY from the bottom up while it is being lowered. As the rate of lowering slows down (preparatory to adding another joint of casing) the pressure drops and the Variable Valve closes, thus maintaining the desired fill without overfill or overflow.

This AUTOMATION cycle is repeated each time a joint of casing is added and the string is lowered. There is no build-up of dangerous pressures which might cause lost circulation by breaking down weak formations—no mudded-off production zones—no stuck casing resulting from "no-motion" time while surface filling.

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New ideas needed on curbing imports

IMPORTS of crude oil are going to be curtailed by government action some time, some way. That's a safe bet. The political and economic pressures will build up until something is done.

The big questions facing the Government and the industry are by how much and by what means. And the second question is more important, for the long run, than the first.

Whatever limit is determined for imports will doubtless displease both importers and domestic producers. But both could adjust to a half-way reasonable figure. The really important thing here is that the whole industry know how to plan for the future.

BUT THE MEANS to be chosen is all important. A faulty method could be a cure worse than the disease. It could injure foreign relations, disrupt the industry, fall short of its objective, or collapse of its own weight.

Some original and constructive thinking is needed on this matter. There are those in the industry who seem content to let the Government wrestle with the problem. But the Government ought to welcome a variety of well-thought-out suggestions, and the industry ought to volunteer some.

Here's an opportunity for "brainstorming" on a grand scale. The problems of limiting oil imports are different from those of any other commodity. The customary tariff or quota devices won't fill the bill. A novel and custom-built plan is needed.

The heart of the problem is to bolster national defense by lessening dependence on remote sources of oil, favoring Western Hemisphere supplies, and maintaining a healthy domestic industry with some reserve capacity. This must be achieved without undue violence to our foreign policy, injury to domestic consumers, or gross inequities within the oil industry.

SOME NEW IDEAS are already being talked around: A sliding-scale tariff based on the distance oil is carried; a tax on tanker imports but not on pipeline imports; a quota for each refinery, with those not using theirs selling them to others; various combinations of tariffs and quotas, with enough administrative flexibility to permit frequent adjustments.

The point is that open discussion of all such and any other new approaches may finally develop some one method that is practical. Sure, they all seem to have "bugs" in them at first glance. But none should be summarily rejected without open-minded consideration.

Up to now one big reason why imports have not been curtailed is that no satisfactory method is at hand. But if pressure for limitation gets stronger, an unsatisfactory method may be improvised in haste.

So now is the time for importers, producers, refiners—everybody in the industry—to openly discuss all possible methods.

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the OIL AND GAS JOURNAL

June 10, 1957

THIS IS THE TEAM* that makes Phillips Petroleum Co.'s research program click.

Why Oil Research Pays off for Phillips

W. A. Bachman
District Editor

BARTLESVILLE. — It's no accident that Phillips Petroleum Co. ranks higher in research than many companies much larger.

The reason is simple: Through the years its smart management has energetically followed this pattern:

. . . **Made research an integral part** of company growth and expansion.

. . . **Built up a research group** on a formula of brains, imagination, curiosity and teamwork.

. . . **Kept these scientists close** to the company operations, not in an ivory tower.

. . . **Kept a share of these technical people** working on the unknown—always watching for things that can be profitably linked to the company's business. Currently, for instance, they're busy probing into rockets, atomic energy, new chemicals, and automation besides advanced phases of oil, gas, and refining research.

Its string of successes has pushed Phillips into second place in the oil industry in number of patents held. It also has ranked second for the past 5 years in number of patents received in a 12-months' period. During 1955, Phillips took out 292 U. S. patents and 89 foreign patents. These operations gave the company a total of 2,701 active U. S. patents and 476 foreign patents in 23 countries.

All this activity was pointed up only a few weeks go when Phillips dedicated a new laboratory and research center near Bartlesville, the company home office. The bright new facilities in themselves underscore how far Phillips has come in a few years.

How it got started . . . Phillips got into research initially because of a law suit back in 1925.

The company was being sued by a major concern for infringement on a patented process for extracting liquids from natural gas. Frank Phillips, founder of the company and its president during the formative years, was convinced the charges weren't true. He decided to fight the case in court.

Phillips brought in three young scientists who had been sharpening their spurs in college teaching and research jobs. He put them to work studying the process Phillips was using. Their laboratory was a crude boiler room of a plant at nearby Burbank.

The scientists were told the work was only a 2-year project at most. So they only took leaves from their college jobs. They turned up enough facts about natural-gas processing to win the case for Phillips. But in their research they discovered many other exciting things about natural-gas liquids. The prospects made Phillips officials blink. They kept the scientists on and enlarged research facilities. That was the beginning of the pioneer

*IN PHOTO: Left to right at weekly meeting are R. R. Couch, administration; P. M. Arnold, manager; R. C. Alden, research planning board; R. W. Thomas, vice president; J. A. Reid, research; J. A. Young, patent; C. K. Buell, process development; and M. W. Conn, market development.

PHILLIPS RESEARCH center seen from the air. Pilot-plant area is in foreground and new lab building in background.

work which since has made Phillips a giant in the natural-gas and gas-liquids fields.

The new lab . . . Phillips has never thrown a lot of money into fancy laboratory buildings down the years. It has put much more emphasis on the men who do the research and on inspiring them to operate as a team.

As a result, laboratories for different projects sprang up all over Bartlesville—in shops, office buildings, and special plants. Other laboratories were set up in field areas where they were integrated with specific manufacturing projects.

With continued growth, management felt its research efforts could be coordinated more efficiently if a large part of them were housed in one center. The new three-story research building was the result. Phillips research people visited other laboratories over the country. They incorporated ideas of others plus ideas that fit Phillips' own special needs into a strictly utilitarian building.

The new building is not a plush country club for doctors of science. It's clean, comfortable, and roomy—at least for present needs. It has 60 individual 20 by 30-ft. labs interspersed with office space. All the latest safety features are incorporated to protect researchers from the hazards of working with unknown forces of nature. Conference rooms, cafeteria facilities, and a library also are included. But more important: The building is filled with the latest instruments, machines, and tools for major-league research in many scientific fields.

Phillips also has built a new building nearby to house its plastics sales service laboratories. Here answers are found to production problems of manufacturers who use Phillips polyethylene and other plastics. New product uses also are sought for the materials bought by Phillips' customers.

Located on the same acreage are the automotive and fuel laboratories and pilot plants. When a process gets too large for the test-tube stage in the laboratory, Phillips researchers take it to a pilot plant for further study. Also if a process might endanger safety of the laboratory, the scientists take it to the pilot-plant area where work is carried on behind thick concrete walls.

Phillips people—from management down to lab workers—are proud of their new buildings. But a visitor immediately is struck by a curious attitude which pervades the center. The Phillips researchers view the building as a nice place to work. But they're much more interested in what they're doing.

The research setup . . . This preoccupation with the scientific attitude probably springs from the way Phillips selects its research people and keeps them abreast of scientific developments.

Philip M. Arnold, who manages Phillips research and development, has put the personnel goal this way: "Creative scientists and engineers are the one thing which a research and development department cannot do without. Equipment, space, and supporting personnel can be deficient, and the department can still function."

Phillips hires men trained and skilled in a variety of sciences. It tries to get men who, in addition to skill, also have traits of curiosity, creativity and inventiveness. Admittedly much of this is determined by trial. But Phillips' officials believe they never lose a talent even if a new employe doesn't live up to all the superior traits desired. The company's research program covers such a broad scope, many different type of men can be used effectively.

When Phillips has a special research project in the mill, officials may take a long time looking for just the right man to head up the job. They probably won't start the work until that man is found.

Research at Phillips, like most other industrial research, is done on a team basis. The problems are so complex it might take one man alone a lifetime just to get started. Answers naturally are needed more quickly than that. Time not only is essential but also expensive. Sometimes the machines used in research draw higher wages than the men using them. So both must be kept busy.

Individuality is not lost through the team work, however. Any team has its "stars." Their merits are recognized by their colleagues, by the public, and by management. Each team is carefully organized and maintained to bring a variety of scientific skills to bear on the special problem.

Phillips also strives to keep a proper balance between scientists and technicians in its research organization. Arnold says the present shortage of engineering and scientific talent makes it imperative to keep professional personnel from doing routine work which can be done by persons with less training.

"We try not to confuse education

with intelligence," he says. "There are many intelligent persons who do not have college training. With proper direction they can perform complex tasks."

Of the 1,300 persons employed in research and development, 580 are professional scientists and engineers with degrees from 187 colleges. This is a ratio of 1.2 technicians for each scientist. Phillips is trying to increase this ratio in order to further free its scientists for more creative work.

Phillips employs the usual methods of communication and crosscommunication in all divisions of research. The teams conduct frequent conferences to discuss their problems. Team supervisors also hold meetings, and so on up the management ladder. In addition, the company also calls in special consultants for specific work and conferences. Experts in many scientific fields periodically give lectures on advances in science. Every 60 days departmental meetings are held, and the program usually includes a lecture.

How it works . . . The research and development work at Phillips is distributed among seven distinct divisions.

Several divisions deal with scientific studies in oil exploration and production, manufacture and use of fuels and lubricants, synthetic rubber, chemicals, and plastics. Other divisions exploit process development, market development, and patents. The atomic-energy division operates facilities for the Atomic Energy Commission at Idaho Falls, Idaho. The rocket-fuels division is doing development work for the Air Force at McGregor, Tex. Administrative work for the entire department is handled by a general services division.

The scope of Phillips research is easily seen if its work is examined. Among its interests are:

. . . Finding the exact composition and properties of the components in petroleum and natural gas.

. . . Finding new processes, equipment, and products and improving old ones.

. . . Solving unusual operating problems for other departments of the company.

. . . Solving customers' technical problems.

. . . Finding and appraising new markets for old products and finding markets for new products.

. . . Conducting patent and licensing activities.

. . . Assisting advertising and public-relations work of the company.

The successes . . . First-rate discoveries still often have apparent unrelated beginnings. This despite all the machinery to concentrate many skills on a single problem.

It's more than luck. In nearly every case, the germ of the idea for the discovery resulted from having the right man—one with curiosity — on the job at the right time. That's why Phillips puts so much emphasis on this trait in its researchers.

Just one of many cases in Phillips' experience:

In the field of alkylation, the company's technology had its beginning in a partly accidental and important discovery of the "paraffin - olefin juncture" reaction. In the early days of Phillips research two workers were experimenting with thermal polymerization of olefins in a paraffin-olefin mixture. The experimenters noted that in addition to the expected product of olefin - polymerization, a minute amount of longer-chain paraffin-type molecules appeared. They were not originally present. The researchers determined that the unexpected material, "alkylate," could only have occurred by the direct uniting of olefins with paraffin, a new reaction.

A commercial plant later was built and operated to produce neohexane, a potent ingredient for aviation gasoline, by the thermal-alkylation reaction between isobutane and ethylene. Phillips also pursued experimentation with catalysts for the alkylation reaction and was the first to put a commercial HF (hydrofluoric acid) alkylation plant on stream.

By a different catalytic route, Phillips also developed commercial production of isopropyl, a different isomer of the isobutane-ethylene reaction and one giving exceptional performance in high compression engines. Thus did curiosity about a few drops of unexpected hydrocarbons become linked to a chain of outstanding commercial events.

It's also easy to see why Phillips puts so much emphasis on teamwork, when just these two incidents are examined:

Several years ago the best brains of the aviation-engine and fuels industries were having trouble getting a machine to measure properly the detonation of fuel in airplane engines. They had worked on the problem for nearly 10 years with only limited results. One day a physicist at Phillips overheard his colleagues discussing the problem. He was amazed. He told his friends it was a problem a good high school physics student could solve easily. To prove his point, overnight he rigged up a system of circuits on "breadboard" that could test the detonation accurately.

As one veteran Phillips research official commented: "Here was a physicist who had the answer to a 10-year-old problem in his head. He didn't know it was a problem to anyone. We try to make sure now that all hands know what the big problems are in other labs. The man in the next lab trained in another field of science may have the answer."

Phillips' experience in the early war years has put it far ahead of the crowd in automatic - control instruments. The company, like many in the industry during this period, had trouble keeping an adequate staff of chemists at its manufacturing facilities. Finally, a team of physicists was sent out from Bartlesville to study particularly the rubber plant at Borger and devise control instruments wherever possible to replace chemists. They came back to Bartlesville and went to work. They came up with one automatic control after another until the plant was nearly as automatic as possible. Phillips still has strong research teams working on the problems of automatic controls.

The payoff . . . Phillips' research and development work over the years has paid off with an impressive list of "firsts" in the oil industry.

The company was first in the oil industry to:

. . . Design and operate a multi-product long-distance pipeline.

. . . Make aviation gasoline commercially by the hydrofluoric acid alkylation method.

. . . Produce a superior furnace carbon black for use in tire-type rubber from oil instead of from natural gas.

. . . Develop and commercialize a successful low - pressure polyethylene process in this country.

. . . Produce diisopropyl alkylate.

. . . Offer high purity cyclohexane from oil to the chemical industry for processing into nylon.

. . . Operate an atomic reactor.

. . . Produce commercial tire - type synthetic rubber from raw material to finished product.

In addition Phillips pioneered in developing the L.P.G. market, butadiene, robot instruments, and rocket-fuels from petroleum - based ingredients.

All this developed in 32 years from a start with a three - man research team. And Phillips research people confidently believe the next 32 years will be just as bright with new vistas open in petrochemicals, atomic energy, automation.

They point to broad, vacant acres at their new research center and observe: "We have plenty of room to expand."

Gas Bill Showdown Near

● House leaders are still confused on administration's views despite Eisenhower's latest words of encouragement

WASHINGTON.—The House commerce committee, still in the dark as to administration intentions, starts this week to ready the Harris gas bill for the House floor.

The aim of the bill, to exempt producers from federal control, got a big boost from the White House last week. But President Eisenhower did not say whether the administration would still press for the changes it demanded a month ago.

The president was asked directly whether he still feels that freedom of gas producers is absolutely essential. This was his answer:

"Yes. I believe that a reasonable bill to encourage exploration for gas and oil in this country is just as much in the interests of the consumer as it is of the producer.

"I don't, by any manner or means, say that someone with a monopoly on this kind of fuel should be able to exploit the country to the full. You do have these public utilities which are the interstate pipelines, but I seriously object to any kind of public-utility control over the well or the producer himself."

ODM amendments . . . House leaders, who have kept aloof from the fight so far, appeared encouraged by Eisenhower's statement. But they still were in doubt as to his position on the amendments to require the Federal Power Commission to consider cost in passing on producer prices and review escalation clauses in existing contracts.

The President's statement was along the same line, but stronger, that he followed in responding to a similar question a few weeks ago. But in the meantime, Charles H. Kendall, counsel for the Office of Defense Mobilization, laid the amendments before the committee as the minimum the administration would take.

On the strength of Eisenhower's view and his failure to talk about the amendments, backers of the bill may make an effort to blast it out of the committee without changes. That would put the next move up to the administration. A poll of the committee reportedly showed that supporters would have a margin of two votes over their opponents.

If the move to vote the bill out fails, revamping of the measure will be a tough job. The aim will be to get a bill acceptable, if not entirely satisfactory, to Congress, the industry, consumers, and the White House.

Critics of the measure as now written say that unless it is greatly changed they will not go for it. But supporters say that any material changes would make the bill unworkable.

A great many ideas for changes were offered the committee during a month of hearings that ended last week. But the fight over the bill will center largely on the administration amendments and these two additional issues:

. . . Demands from coal interests that the FPC control direct gas sales and ban below-cost sales. This is supported by the administration.

. . . Control of larger companies. The idea that the 60-odd largest gas producers be controlled, and all others exempt, is backed by a number of members of Congress.

Use of cost by the FPC appears to have the best chance of being put into the bill. Eisenhower did not rule out the possibility he would press for this. He specified he opposed "public utility control."

FPC position . . . FPC Chairman Jerome K. Kuykendall also has come out in support of the idea. He told the committee last week he believes the ban on cost in the Harris bill should be dropped.

Four members of the FPC, however, are opposed to the reopening of existing contracts. Kuykendall said it would result in a "glaring inequity." If the FPC is to have the power to review escalation clauses, he said, it should also be allowed to review contracts with no step-up provisions.

The one dissenting member of the FPC was Commissioner William R. Connole. In a letter to the committee, he said the aims of the bill could be reached by simpler means. He suggested that the Natural Gas Act be amended to relieve producers from securing certificates and give the FPC more latitude than the utility cost-of-service rate base in reviewing rates.

Other views . . . In the closing days of its hearings the House group received two opposing views of the bill.

Walter P. Reuther, president of the United Auto Workers, charged it would cost consumers $930 million a year in higher rates. And it would increase the value of present reserves by more than $30 billion, giving the industry "one of the greatest windfalls in history," he charged.

But John Heyke, president of Brooklyn Union Gas Co., said the bill would protect consumers while giving the industry an incentive. Heyke, who led the distributors' fight against the Harris-Fulbright bill in the last Congress, said the outlawing of spiral escalation affords the protection the local gas companies want.

As the hearings ended, Chairman Oren Harris of Arkansas said he would not renew his plea for a change in the administration's stand. The committee will go ahead with the bill without waiting to see what the administration will do.

Harris indicated that thought is being given in the administration to dropping its amendments. But he said it is up to the administration to do its own talking.

Lobby Bill Due

Gas-education funds not deductible, IRS declares

WASHINGTON.—If the oil industry is trying to "buy" senators, a 15-month probe by a special Senate committee has failed to uncover any evidence of it.

The inquiry has had two results, however. It led to a ruling by the Internal Revenue Service that contributions to the Natural Gas and Oil Resources Committee which worked for passage of the Harris-Fulbright bill are not allowable as deductions against federal taxes. And a new and stiffer lobbying bill is being written.

The probe grew out of a disclosure by Sen. Francis Case of South Dakota that he had been offered $2,500 "oil money" for his campaign fund. Coming just before the Senate passed the gas bill, this was used by President Eisenhower as a reason to veto it in February 1956. The persons involved in the incident were later fined in the District of Columbia Federal Court for violation of the lobbying laws.

The special committee, headed by Sen. John L. McClellan of Arkansas, filed its report last week.

"Despite intense effort to secure leads on other acts of illegalities or improprieties, if any, our committee was not apprised of any such episodes and discovered none by independent investigation," McClellan said.

McClellan intimated that Eisenhower had exaggerated the situation in his veto message. The President,

director of the budget, and attorney general were invited to give any facts they had about other incidents, he said.

"No evidence or information was furnished to the committee from these sources," he commented.

Freight Case Won

Charges in Texas will be revised if ruling stands

AUSTIN.—The Texas Railroad Commission has won the second round of a court battle with Sun Oil Co. over freight rates for hauling casing and drill pipe.

The fuss concerns whether pipe shipped originally from Pennsylvania and stored temporarily at Houston should be subject to intrastate freight rates on the last leg of the trip from Houston to drilling sites.

The commission November 14, 1955, held that the pipe journey was broken at Houston and intrastate rates should apply from that point.

Sun took the matter to court. The lower court ruled in the oil company's favor, holding the Houston-to-oil field journey to be interstate as a part of the longer shipment from the East.

The commission renewed the dispute in the Third Court of Civil Appeals, which reversed the lower court. The appeals court held that the shipment was broken at Houston and that from there on the commission-imposed tariffs should apply.

In Sun's case, the pipe was shipped from Pennsylvania by barge to Houston, unloaded and taken to storage yards of a specialized motor carrier there, then held until ordered shipped to specific points by Sun.

The decision, if it stands, will apply to similar shipments by other operators.

Ruling Favors Pipelines

AUSTIN.—The Texas attorney general ruled last week that a pipeline doesn't have to pay the cost of lowering a line when right-of-way for an existing road is widened.

Atty. Gen. Will Wilson held that the governmental agency acquiring the extra right-of-way must pay the pipeline the costs of lowering the line plus cost of any additional casing needed.

Wilson ruled in answering a query from the Matagorda county attorney. At issue was a county road which is to become a state farm-to-market road. The state asked the county to obtain a wider right-of-way. Wilson's ruling means the county must pay the pipeline relocating costs.

Humble Plans Big Cycling Plant

CORPUS CHRISTI.—Humble Oil & Refining Co. last week disclosed plans for construction of the world's largest cycling plant and a pipeline network which will permit first big-scale production of gas from the sprawling King Ranch.

Tentative plans call for a gas processing and cycling plant with a capacity of about 750,000,000 cu. ft. It will be designed to recover approximately 25,000 bbl. per day of liquid products consisting primarily of propane, butanes, and a mixture of natural gasoline and heavier hydrocarbon liquids.

Humble also revealed that studies are under way for construction of a major gas-transmission line from the Southwest Texas area to the vicinity of Houston. This pipeline, some 250 miles in length, would be of 26 or 30-in. diameter.

Although much of the dry gas will be recycled into the producing formation for pressure maintenance, an undetermined volume would be available for sale to industrial users. In keeping with the company's past policy, gas would be sold intrastate, thereby avoiding federal regulations.

Cost of the entire project, including transmission and gathering lines, has been estimated at about $75,000,000.

Construction of the gas plant probably will not begin until late 1958, Humble indicated. About 2 years would be required to complete the project.

Site of the proposed plant has not been determined. But the Kingsville-Bishop or Alice areas are considered among the most likely locations.

In addition to the transmission line, the expansion program calls for construction of some 200 miles of main gathering lines of varying sizes. They would connect with Humble fields in eight or nine Southwest Texas counties, including Kleberg, Jim Wells, Brooks, Duval, Kenedy, Jim Hogg, and Nueces.

Most of the gas would come from wells on the King Ranch, many of which have been shut in for years. The gas would be available to plants in the Houston-Baytown-Beaumont area where industrial customers are now being served by Humble's existing gas system. Humble's existing Calallen gas pipeline system which supplies industrial customers in the Corpus Christi area also would be connected to the proposed processing plant.

Most of the products from the plant will be shipped by pipeline. However, plans also call for facilities to load tank cars and trucks.

Humble leased more than 1,000,000 acres of the King Ranch in the early 1930's. Since then, the company has established prolific oil and gas production at numerous fields on the ranch. In recent years most of the gas discoveries have been capped for lack of suitable markets.

Costly rig heads for gulf:

. . . C.A.T.C. Hires Mr. Gus II

BEAUMONT.—C. G. Glasscock Drilling Co.'s new mobile platform, "Mr. Gus II," will start drilling for the C.A.T.C. Group off the coast of Louisiana about the middle of June.

The $6,500,000 vessel, commissioned at the Bethlehem Steel Co. shipyard here May 31, will be outfitted in the Sabine Pass area after floating down the Neches River. Completion of the derrick was postponed because of low bridges across the river.

The four-company C.A.T.C. combine has a multiple-well drilling program scheduled for "Mr. Gus II."

First test is tentatively set for Block 48, Grand Isle area, in water about 80 ft. deep. This will be a flank test about 5,000 ft. west of production in Block 47 field.

Second well to be drilled by the new platform is expected to be in deeper water and farther at sea, in Block 46. Water depth in that area ranges from about 95 to 115 ft.

How it operates . . . "Mr. Gus II," most expensive drilling vessel yet built, is designed for operations in 150-ft. water during the nonhurricane season. It is intended to operate in water as much as 125 ft. deep in the hurricane season. With correct soil conditions under the lower hull, it is designed to withstand hurricane winds of 125 m.p.h. and waves 55 ft. high.

The upper platform measures 173 ft. by 104 ft., and the lower mat is 200 ft. by 180 ft. Four steel columns 235 ft. long and 10 ft. in diameter support the upper deck when it is jacked up into drilling position. Steel piles 130 ft. long and 7 ft. in diameter will extend into the gulf floor.

O.C.A.W. Has New Bait

● Big union's 1957 success may be used to entice less fortunate independents who got less than 6 per cent

DENVER.—The powerful Oil, Chemical, and Atomic Workers International Union is armed with an effective weapon for use in membership raids on other oil-industry unions.

It's the 6 per cent increase which the 105,000-member O.C.A.W. won in its 1957 wage campaign *(The Oil and Gas Journal, May 20, page 124).*

The 12,000-member Central States Petroleum Union was forced to settle for only 5 per cent from Standard Oil Co. (Ind.). And the Independent Petroleum Workers of America agreed to even less—4 per cent at Indiana Standard's Whiting refinery.

O.C.A.W. also won double time and a half for holiday work. The best the other organizations could gain was time and a half. All new contracts provide an eighth paid holiday annually and 4 weeks' vacation after 20 years' company service.

When asked if O.C.A.W. would dangle the 6 per cent as bait in organization efforts against rival union members, one union official said the O.C.A.W. doesn't plan any particular campaign on that point.

"We wouldn't stand on that point alone," he said. "We carry on a constant campaign to demonstrate that we do a better job than they do."

C.S.P.U. and I.P.W.A. are affiliates of the 30,000-member Federation of Independent Oil Unions, formed about 18 months ago to escape engulfment by O.C.A.W.

Their arguments against the big union were weakened considerably in this year's wage drive which saw O.C.A.W. achieve two-thirds of its 27-cent hourly goal while C.S.P.U. settled for half the amount it sought and I.P.W.A. settled for even less than half.

Sinclair stumbling block . . . With one exception O.C.A.W. has concluded its wage drive for this year. Sinclair Oil Corp. and the union were continuing their negotiations last week at Kansas City on a nation-wide contract covering about 10,000 refining, production, and pipeline workers.

Bargaining sessions were expected to run right up to the June 14 expiration date of the existing contract. The union reserved the right to serve 24-hour strike notice.

Progress is slow because this is the first time in 5 years that the master agreement has been for improvements in such items as health and hospital programs, and pensions.

Sinclair has already agreed to 6 per cent wage increase, but a squabble has developed over effective date of the increase. Other oil companies generally granted O.C.A.W. a 5 per cent increase effective April 1 with the 6 per cent going into effect May 1.

O.C.A.W. officials declined comment on a statement by Robert L. Wood, president of the Independent Petroleum Association of America that domestic oil companies are entitled to an immediate 4-cent a barrel increase in the price of crude oil to offset the 6 per cent increase.

Gulf Coast calm . . . Tension eased at Gulf Coast refineries last week following wage agreements between O.C.A.W. and two major oil companies.

A strike threat ended at Shell Oil Co.'s big Houston refinery when Shell granted 6 per cent with fringe benefits to some 3,000 union workers. Agreement was reached nearly 10 hours after termination of the previous contract.

The Shell offer came shortly after O.C.A.W. locals at Port Arthur voted to accept a 6 per cent increase from Gulf Oil Corp. Provisions of the new Shell contract were similar to those granted by The Texas Co. to workers at the Port Arthur and Port Neches plants a week earlier *(The Oil and Gas Journal, June 3, page 76).*

Two small locals were still on strike at Houston plants operated by Crown Central Petroleum Corp. and Nyotex Chemicals, Inc. Local issues were said to be blocking agreements in both plants.

Tioga Spacing Issue Dead

BISMARCK, N. D.—Fears of oil operators that drilling in areas adjacent to Tioga-Madison field might revert to 40-acre spacing evaporated last week.

The North Dakota Industrial Commission extended the field's limits to include a large area to the north. This automatically brings the area under 80-acre spacing requirements.

In addition, Warren Petroleum Corp. announced it has no immediate plans for new wells near its 1 Setterlund. Warren said this well had been allocated 80 acres and the company had never considered anything but 80-acre spacing for adjacent acreage.

Warren had asked that the 80-acre spacing pattern for new areas around its 1 Setterlund be based on an east-west axis, instead of the north-south plan followed in Tioga-Madison field. Some operators had felt this would give the well's south offset the equivalent of 40-acre spacing.

New Unit Approved

Climax, Apco buy Gardner wells in East Goldsboro

AUSTIN.—Operators in East Goldsboro (Gardner) field of Coleman and Runnels counties in West Central Texas have the green light to unitize and launch a flood expected to increase recovery by almost 3,500,000 bbl.

The Texas Railroad Commission last week approved an application by French M. Robertson, Abilene, Tex., and other operators for the program.

In an unusual deal, Robertson and others immediately sold their production to Climax Molybdenum Co. and Anderson-Prichard Oil Corp. Climax-Brundred water-flood division of Climax Molybdenum Co. will operate the properties.

The Climax-Apco offer to buy the properties was conditioned on approval of the unit and flood plan. The sale is effective as of June 1. Involved are 2,030 acres and 48 wells producing from the Gardner.

The unit agreement was signed by 100 per cent of the working interest and 92.154 per cent of the royalty interest in the area at the time of the commission hearing.

Plans for a field-wide flood were completed when a pilot water-injection project, in action for several months, began to show favorable results. James E. Russell, Abilene water flood consulting engineer, estimated that the field-wide project would cost about $750,000.

The Gardner pay in the unit area is essentially depleted by primary producing means. Sam L. Robertson, general manager for French Robertson, testified that only about 99,000 to 100,000 bbl. of primary production remains. He estimated the property is 96 per cent depleted.

Robert W. Hines, production manager for Texas Pacific Coal & Oil Co., said his firm plans to expand its neighboring water-flood operation and cooperate with the unit.

L.P.G. Slug Planned

Tekoil Corp. to try latest method at Sunflower field

DALLAS.—Tekoil Corp. may try its hand at the latest method in secondary recovery — miscible - phase displacement.

The Dallas firm, which specializes in secondary - recovery projects, has bought 34 producing wells in Sunflower field, Lincoln County, Oklahoma, and is studying feasibility of injecting butane and propane, followed by natural gas, into the producing zone.

W. H. Davison, Tekoil president, said the firm began an engineering study several weeks ago at the request of another major producing company in the field.

If the plan is carried through, Tekoil will be one of the first smaller companies to try the new method. Several big companies have projects under way.

The object is to sweep the reservoir with a solvent that is miscible with crude. It promises recovery of 85 to 90 per cent of oil in place, as compared with 55 to 60 per cent by water flooding and natural-gas drive.

Tekoil bought the property from E. L. Oliver, Davis Investment Co., and Muter Co. Purchase price involved oil payments and an undisclosed amount of cash. The wells produce about 50 bbl. daily from the Checkerboard formation at 3,900 ft. Tekoil plans to spend $100,000 to drill 10 more wells in the field.

Court to Decide "In-Oil" Tax

WASHINGTON.—The long-standing issue of how "in-oil" payments shall be taxed will be decided by the U. S. Supreme Court at its next term.

The court last week agreed to review an appellate court decision in five cases. It will decide whether such payments should be taxed as income or as capital gains.

Lower courts in the past have rendered conflicting decisions on the taxability of "in-oil" payments received by owners of oil properties who sell future production and take a share of the output in payment. The appellate court, however, held that such payments should be treated as capital gains and the Government appealed.

The same question came before the House ways and means committee last month when it was writing a tax-revision bill. The committee, however, decided not to write new provisions until the Supreme Court acts.

watching WASHINGTON

. . . with Bertram F. Linz

Oil and atomic war . . .

MOBILIZATION officials have been taking a long look at our industrial defense against attack. Summed up: It's not too good.

They found that 49 per cent of the vital oil industry is herded in 18 areas, measured in employment. Nearly 58 per cent is in 36 areas. And 62 per cent is in 57 areas. A single atom bomb could wipe out any one of these areas by blast, fire, and fallout.

Here is what the experts believe: Producing fields are not likely to be attacked. They are spread out in many states and aren't good targets. Pipelines also are pretty safe. The lines themselves are underground, the stations small and hard to see from the air. Both would be vulnerable to sabotage.

Tankers, of course, would be prime targets. That was proven in World War II. But storage terminals and refineries would be the major object of air attack. They are generally located in industrial centers. But large refineries may be considered targets regardless of location.

If we were attacked, what would happen? The experts say that with detailed data on our plants, which it may well have already, our most likely enemy could do a lot of damage. If the enemy's planes could get through our defenses—and it's admitted that a good percentage probably could—the results wouldn't be pleasant.

An ODM count showed that there are 367 refineries in this country. But 38 of them produce 88 per cent of our lubricating oil and 81 per cent of our aviation gasoline, and process 53 per cent of our crude oil. That's what worries the defense planners.

And in case of war . . .

THE job of planning to keep the oil industry going in wartime will be taken over by the Interior Department next month.

For the past several years this work has been carried on in Commerce. But Congress lopped more than a third from that department's budget for defense planning last month. So it is necessary to drop about 125 people and cut out all work that can be handled in other agencies. As a result, the oil-field machinery branch is being wiped out.

The big job of this branch in peacetime is to keep abreast of industry growth. It keeps records on the use of material and equipment. With the estimates of the military and other agencies, it works out what and how much material would be needed in the event of war.

The basic idea is to see that the industry gets what it needs to produce the military and civilian requirements in an emergency. Many in the industry—and in the Government—remember the tough times of World War II when it was thought all we had to do to get oil was turn a few valves.

War-born product expands . . .

SYNTHETIC rubber based on oil is heading into a great expansion period.

Natural-rubber production, 1,888,000 long tons in 1955, will level off this year at 1,900,000 tons. It will hold at that figure for at least 3 years, the Natural Rubber Bureau predicts.

But world rubber consumption will increase at a steadily faster pace. It was 3,020,000 tons in 1956. This year it will be 3,100,000 tons. By 1960 it will be 3,500,000 tons.

This will call for an output of 1,600,000 tons of synthetic rubber in 1960, compared to 1,132,000 tons last year. Over 85 per cent of this will be made in the United States.

U. S. synthetic capacity in mid-1956 was 1,150,000 tons. This has already increased to 1,430,000 tons. The rubber bureau estimates it will go on increasing. It foresees a capacity of 1,590,000 tons next year, 1,710,000 in 1959 and 1,860,000 in 1960.

MICHIGAN'S Peter Lederman tells why . . .

Gas by Tanker in Sight

Ships will be moving liquid methane to European market when remaining technical and cost hurdles are cleared

KINGSVILLE, Tex.—Serving Europe with liquid methane by tanker is in the cards. Technological and economic hurdles remain. But day by day they are becoming less formidable.

Europeans, feeling the pinch of skyrocketing energy demands, long have considered the vast natural-gas resources of the Middle East and Venezuela as a possible answer to their acute problem. With a few breaks, they may be getting this natural gas by the boatload in the near future.

This was the prospect held out by Peter Lederman and Dr. Brymer Williams of the University of Michigan. Lederman read their paper at the annual short course in gas technology held at Texas College of Arts and Industries.

The cost . . . A tanker load of liquid methane delivered in Great Britain could be sold as a gas at 80 cents per M.c.f., Lederman said.

This would compare with a price range of from $1 to $2 per M.c.f. for manufactured gas.

Lederman explained that many factors enter into the delivered cost. He revealed that an economic study showed over-all costs will split almost evenly between processing-transportation and storage.

Raw-material costs also can become an important factor. For the purposes of the study, Lederman said 4-5-cent Venezuelan gas was taken as the base stock. But even higher-priced Gulf Coast gas gave an attractive differential until 20-cent gas entered the picture. Even then, increasing energy costs in Europe are expected partially to offset any higher field costs of the gas.

The technology . . . Barriers of technology to moving gas by tanker are crumbling, Lederman said.

Oxygen manufacturers already have done much to whip the metallurgical problem. Liquid methane has a temperature in the minus 250°-260° F. range. This means metals used for transport and storage must withstand the shock of extreme temperatures. But both nitrogen and oxygen have temperatures much lower than methane in the liquid state. Handling these as liquids has become quite common.

Much basic information, however, is still needed to guide equipment designers and engineers planning special plants. These facts are important because the initial investment in compressors is so great an overdesigned plant could play hob with economics of delivered cost.

This is complicated by the gas to be handled. It won't be a pure methane stream. So the critical temperature and pressure at which all components will liquefy becomes an important question bearing on compressor costs.

Formation of solids is another stickler. Hydrogen sulfide, for instance, has a solubility of 0.0023 per cent at —260° F. It will have to be removed. Carbon dioxide is less of a problem. It can be tolerated up to 0.5 per cent in liquefied methane and can be removed by conventional equipment. Aromatics may cause difficulties, and here is where additional studies are needed.

Presence of hydrocarbon diluents isn't necessarily bad, Lederman pointed out. Once the gas stream has been liquefied, it's simple and cheap to remove the heavier components—such as ethylene, propane, and butane—by fractional distillation. The pure streams recovered can command high prices as petrochemical stock.

How to make it . . . The best process to use in liquefying methane also hasn't been decided. Most researchers believe the ultimate winner will be the Cascade process, a modification of the Linde method.

In the Cascade process, incoming high-pressure gas is compressed and cooled in two successive steps. It is subjected first to a propane refrigerant stream and then to an ethylene refrigerant stream. The gas is further cooled in a self-refrigeration step both at —218° and —260° F. where it is expanded essentially to atmospheric pressure.

The Claude process has been proposed as another method of processing the methane. In this a slipstream of gas is removed and passed through an expansion engine which provides refrigeration capacity. The expanded gas is then returned for recompression. Lederman sees disadvantages to this method: A turboexpander is needed which can handle from 20-40 per cent liquids, and these aren't available. Recompression costs will be higher.

In fact, an economic study using a typical gas stream of 80 per cent methane showed the Cascade process had a horsepower cost per M.c.f. nearly half as much as that of the Claude process.

Investment high . . . An operator must expect to invest about $239 million in plant, tankers, and storage to be able to deliver the gas by ship.

A study of a 400 million cubic foot daily plant showed these requirements:

. . . Plant $99 million. Compressors would take the lion's share, about $65 million. Remaining costs split among

process equipment, buildings, utilities, construction and engineering.

. . . Tankers $79 million.

. . . Storage $37 million.

. . . Docks and allied construction $8 million.

. . . Contingencies $22 million.

Operating costs would run about 0.4 cent per M.c.f.

Lederman asserted that tankers still are a big question. Costs of ships have increased tremendously since the Suez crisis. Shipyards are still booked full with high-priced ships on the ways. The first units thus would have to be built on a cost-plus basis.

A 60,000-ton tanker would have a capacity of 1,400 million cubic feet. It could be fueled from evaporating gas. If this weren't done, a small recompression unit would be needed on the ship.

One cost-trimming development already has occurred. Instead of double-walled storage vessels used in the past, single-wall compartments and storage tanks properly insulated will probably do the job. Using a standard design for all tankers also should help to keep investment down.

Imports Cut Pushed

Three senators meet with Ike, but action unlikely

WASHINGTON.—Pressure for curbs on oil imports is mounting in Congress but with no sign that anything will be done this year beyond talking about it.

Three senators took the problem to the White House last week. Frank Carlson of Kansas, Everett Dirksen of Illinois, and Joseph C. O'Mahoney of Wyoming, urged President Eisenhower to restrict oil imports to the 1954 ratio to domestic production.

They reported later that the President promised to give "serious consideration" to their appeal. But he made no commitment, they said.

A main argument for import control, it was disclosed, was reports on the size of Russia's submarine fleet.

O'Mahoney and Carlson told newsmen that imports are dangerously above the 1954 ratio. Just before the Suez Canal closed imports totaled 1,043,000 bbl. daily. They dropped to 81,000 bbl. a day after the closing. But last month they mounted to 1,900,000 bbl. daily, they said.

The White House is still collecting information for a study of imports which the President said he would order April 25 when Mobilization Director Gordon Gray reported that they appeared to threaten national security.

Gray himself is continuing his talks with importing company officials.

Adena Flood Nearly Ready

DENVER.—A full-scale water flood is scheduled to get under way by July 1 in Adena field.

Five producing wells have been converted to injection, and 22 more input wells have been drilled and cased. All are expected to be perforated and hooked up to the injection system within the next 2 weeks.

Lines from water-supply wells have been laid, and the injection plant is now nearing completion.

Adena is the largest field in the Denver basin and the first ever unitized under Colorado's conservation commission. A few small units have been formed under federal law.

Adena is a stratigraphic trap with a large gas cap. The injection wells have been drilled in a line along the gas-oil contact. The water will sweep the oil downdip to producing wells.

The flood is expected to add about 30,000,000 bbl. of oil to the 40,365,000 bbl. originally expected to be recovered by primary means. This would mean an ultimate recovery of a little over 50 per cent of the oil in place.

The unit was put together in 1955 and approved by the conservation commission on January 1, 1956. Pure Oil Co. is operator.

Between the time water injection begins and the time the flood water forms a solid front the companies involved expect at least 30 per cent of the gas-cap gas to escape downdip and be produced with the oil. After the flood front coalesces in about 2 years they figure that the pressure buildup will permit gas production from the gas-cap area.

Another unit near . . . Not long after Adena's flood goes into operation unitization of Colorado's biggest field, Rangely, is expected to be completed.

Target date for completion of this huge unit is now early September. Operators in the field have been negotiating on the project for more than 10 years, but only since last July have prospects looked hopeful.

A unitization plan is now being circulated among working interests and royalty owners, and the major operators in the area are optimistic over acceptance to date.

Unitization in Rangely would bring under one operation 519 wells on 19,200 acres. Cumulative production at the first of this year was 218,000,000 bbl., with remaining primary reserves estimated at 150,000,000 bbl. Production last year was 28,302,000 bbl.

Beat 'em by joining 'em . . .

Coal Men Get Behind Gas Bill

WASHINGTON.—With an eye to its own future, the coal industry is backing oil's 27½ per cent depletion allowance and the Harris gas bill.

But again looking ahead, the coal producers are girding for a continued fight on low-cost crude and residual fuel imports.

Oil and gas was a major subject at the annual meeting of the National Coal Association here last week. Prime aim of the coal industry was disclosed to be a 500-million-ton market by 1970.

The big problem is how to help oil and gas price themselves out of the industrial fuel market. The mine owners decided that the Harris bill and limitation of imports is the answer.

Oil's big depletion allowance shows the "favoritism" toward coal's competitors, according to L. Newton Thomas, president of the N.C.A. But it is "realistic," Thomas said, and coal must work to have its own allowance raised.

Top men in the industry blueprinted a campaign to increase coal sales by more than 10 million tons annually over the next 13 years. The campaign includes:

. . . Support of exemption of natural-gas producers from federal control, but with regulation of direct sales of gas and a ban on sales below cost. Given this, gas will quickly price itself out as a fuel for power boiler use, the coal men said.

. . . Limitations on crude and residual imports. Coal spokesmen said failure of the administration to act in this field is directly due to the failure of the industry's leaders to present their case to Congress, the coal men were told.

. . . More pipelining of coal.

Public utilities now using oil and gas expect eventually to switch to coal, the meeting was told. Residual oil is becoming more valuable as a source of gasoline than as fuel for power generation and present indications are that gas will gradually price itself out of that market, William H. Gehring, purchasing agent for Du Pont Co., said.

"The General" Starts 26th Year on Job

THE ONE MAN who has become recognized as "Mr. Oil" in Texas last week turned the quarter-century mark in one job. Ernest O. Thompson observed his 25th anniversary as a member of the Texas Railroad Commission, June 4.

The occasion passed without fanfare for Thompson, who spent the day in his old home town, Amarillo. He admits there are many hectic oil battles still ahead. But none probably will be as significant as the victories he's won over the past 25 years.

During that time Thompson has found himself in the thick of tumultuous events and developments that have molded today's oil industry. He has grown in stature following each event until today he can be described by House Speaker Sam Rayburn as "the man who knows more about oil than any other man in the world."

GEN. E. O. THOMPSON, left, visiting his old home town of Amarillo on his twenty-fifth anniversary on the Railroad Commission, took time out to open the general session at the Petroleum Electric Power Association convention. Here he chats with J. F. Maddox, of New Mexico Electric Service Co., new president of P.E.P.A.

The red-haired mayor . . . Thompson already was a national figure of sorts when he came on the railroad commission.

He was persuaded to seek election to the commission post on the urgent pleas of Gov. Ross Sterling. Pat Neff had resigned to become president of Baylor University, and Sterling wanted a strong man to fill the job. Thompson won and took office June 4, 1932.

Thompson already had been mayor of Amarillo since 1928. He was elected on an impossible platform promising drastic cuts in utility rates and taxes, and civic improvements. In typical dramatic Thompson style the young red-haired mayor fulfilled these promises. When the smoke of battle settled, Amarillo had substantially lower utility rates, lower taxes, and the beginning of a program of civic improvements. Thompson also had attracted national attention.

But Thompson had a reputation for getting things done before he was out of Amarillo High School. Even then he had achieved an enviable business career. He had made a success of a newspaper distributorship, made a substantial profit from buying and then selling first a confectionery and then a drug store, and later was owner of an automobile agency that had set enviable sales records.

Thompson enrolled at V.M.I. but an epidemic closed the school and he breezed through a 6-month course at Eastman Business College. Then at the age of 20 Thompson enrolled at the University of Texas to prepare for a law career. He got his law degree just as the United States entered World War I.

The soldier . . . Thompson has been a citizen soldier all of his adult life.

He joined the Texas National Guard prior to World War I, attended the first officers' training school, and was commissioned a captain in the 90th Division. He served in this unit throughout the war and won promotion to lieutenant colonel, the youngest man to hold that rank.

The title has followed him throughout his public career, although he now holds the rank of lieutenant general as commander of the Texas National Guard. Thompson rejoined the National Guard after World War I and has served with it since, including training duties with it during World War II.

Back to business . . . After the first war Thompson returned to Amarillo and hung out his shingle to practice law.

From the start he had an excellent practice. In a few short years he managed to own two hotels and erect the principal office building in town. It was his role as property owner that made him feel the pinch of high utility rates and taxes and turned his attention to doing something about them. That's why he decided to run for mayor.

Thompson in later years recalled the thrills he's had in serving the public—his home town, the state and nation. Friends estimate this public service, though, has cost Thompson a fortune. He reportedly owns no oil stock and has not profited in any oil ventures in his 25 years with the commission. Associates declare a man of his business talents could have amassed sizable wealth in almost any line of business.

East Texas tamed . . . Thompson was elected to the Railroad Commission at a hot time.

East Texas field, discovered in late 1930, had flooded the world oil markets, driving the price of crude down from $1.10 to 5 and 10 cents a barrel. The Railroad Commission had received proration regulatory authority and Sterling had sent in the Texas National Guard to enforce the law. These plans were upset, however, when the U.S. Supreme Court ruled

that martial law had been illegally declared.

Thompson hardly had settled in his chair when his colleagues on the commission decided he was the man to go to East Texas and take charge. His first order was to shut down the entire field so accurate studies of bottom-hole pressures could be made to form the basis for conservation orders. When the field opened, Thompson invoked the recently passed market-demand law to curtail production.

A series of court fights greeted the market-demand move. The commission finally won with scientific evidence its engineers were able to gather during the first shutdown and a second that followed a few months later. After allowables had weathered the court fight, Thompson took out after the "hot oil" boys who contrived scores of ways to produce and move oil exceeding the allowables.

By 1934 a measure of control had been returned to East Texas. Prices had stabilized at about 95 cents a barrel. But more important: Conservation procedures designed during the crisis to control the field's reservoir pressure became the pattern for other fields in Texas.

Through the years, Thompson has championed secondary-recovery measures in Texas. He has led other fights for the industry, too. He backed off Harold Ickes and his New Deal cohorts in a battle to keep state regulation over oil from being taken over by the federal Government. He was a prime mover behind forming the Interstate Oil Compact Commission in 1935. He led the fight to halt flaring of natural gas. He also has been a public defender of the oil industry and especially the independents.

A look ahead . . . Thompson only recently warned oil men they must keep "the forward look."

Great problems face the oil and gas industry, he said. The three immediate ones are:

. . . Explaining depletion recognition in the tax laws fully to the public.

. . . Preventing imports from supplanting domestic oil.

. . . Freeing natural-gas producers from federal control.

All three can be accomplished by getting the facts and objectives to the people, he said. "Our citizens are fair when informed. Success depends upon education through logic and reason."

His friends fully expect Thompson to be right in the midst of these problems too. His present term expires January 1, 1961, and he has proved unbeatable in past commission election campaigns.

Coolers Pose Headaches

● Air-conditioning units in autos still cut volatility limits of today's gasoline; little improvement in sight

ATLANTIC CITY.—Use of air conditioning in modern cars is still creating a problem plaguing auto designers, refiners, and motorists.

The effect of adding air-conditioning equipment is cutting 1.9 lb. R.v.p. from the volatility limits of today's gasoline. This means downgrading the gasolines which need all the volatile high-octane blending components they can handle.

This was the report on last summer's cars given by J. G. Lillard and T. G. Lipscomb of Humble Oil & Refining Co. They appeared here last week before a convention of the Society of Automotive Engineers.

The Humble researchers reported they saw no general improvement of car design ahead to help solve the problem. However, the story is not entirely discouraging. Each of the three major automotive makers has put out at least one car with excellent vapor-lock protection. Lillard and Lipscomb said they hoped these improvements would be passed on to companion makes by each company.

The problem . . . Volatility limit of gasoline is a growing problem.

Engines are getting bigger. Hood lines are dropping. Power accessories under the hood are crowding in more and more. All these developments contribute to higher underhood temperatures.

Adding air conditioners boosts temperatures that much more. Just how much more was the object of Humble's latest annual study.

The program covered 29 of the 1956 automobiles. Of these 19 were equipped with factory air conditioners. This field represented 12 makes of cars evaluated for fuel-volatility requirements.

What happens . . . The tests showed that the volatility limits of the cars were on an average reduced 0.6 lb. R.v.p. when air-conditioning units were installed.

The borderline volatility at which they could operate without vapor lock dropped another 1.3 lb. R.v.p. when the conditioners were turned on. This is the same situation that existed in a similar test program conducted on 1955 models.

The use of four-barrel carburetors offers some relief. Humble found that cars so equipped had about a 5-lb. R.v.p. advantage over those with two-barrel jobs. Whether this trend toward bigger carburetors will offset the growing acceptance of air conditioning, is a good question.

It's popular . . . Americans, and more particularly Texans in Humble's marketing territory, are going for air-conditioned cars in great numbers.

The present problems of Humble and other Gulf Coast marketers may become general in a few years. This latest threat to gasoline volatility started in 1953 when 41,000 cars hit the roads with air conditioning. Last year, 247,000 new car owners joined the parade, boosting the air-conditioned car production to 529,000.

Total cars so equipped are estimated to top 1,000,000 this year. The projected cumulative totals to 1962 are shown below, together with per cent of air-conditioned cars on total car population.

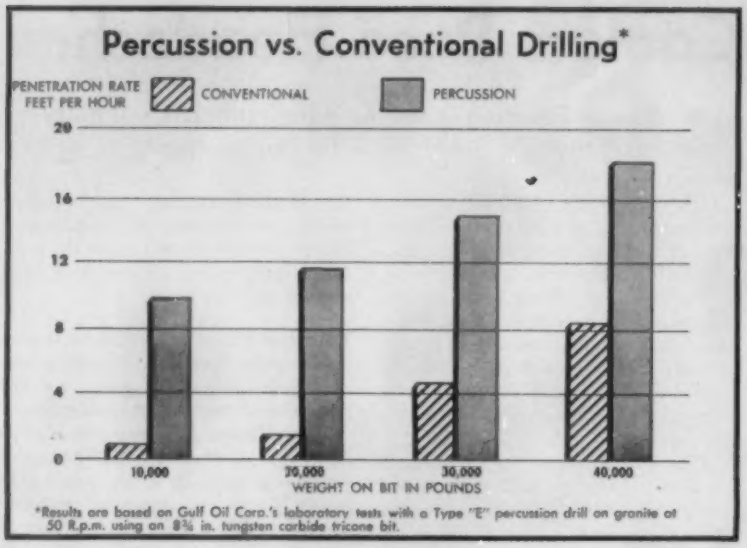
1957	1,029,000	7.7%
1958	1,759,000	10.8%
1959	2,839,000	15.4%
1960	4,239,000	19.2%
1961	5,989,000	23.0%
1962	7,989,000	25.3%

This projection indicates a growing list of vapor-lock problems. By severely taxing the cooling system of the automobile, air conditioning today imposes its effect on fuel volatility. It limits the butane content of gasolines and thus increases production costs.

More compact and more efficient compressors for air conditioners have eased the difficulty somewhat, the Humble authors said. But only a few cars as late as 1956 had sufficient underhood space to permit installation of air conditioners and power accessories without impairing the ventilation and cooling ability of the fuel-handling systems.

Encouraging progress is being made by some individual automobile and air-conditioner manufacturers. Some have raised the fuel volatility limits of cars with and without air conditioning. But the over-all trend seems to be toward greater vapor-lock tendencies with new cars.

This is surprising, the authors noted, for General Motors, Ford, and Chrysler are producing at least one car each which should operate satisfactorily on 12 to 13-lb. R.v.p. fuel at 100° F.



*Results are based on Gulf Oil Corp.'s laboratory tests with a Type "E" percussion drill on granite at 50 R.p.m. using an 8¾ in. tungsten carbide tricone bit.

A New Drill the Answer?

Gulf researchers say hammer drill is faster, straighter, and cheaper for working in the deeper, hard formations

PITTSBURGH. — Gulf Oil Corp. is making available to the industry a new hammer drill. It claims the percussion tool may be one of the most significant developments for drilling in recent years.

The new drill already is fully covered by patents. Licensing negotiations now are under way to make the tool commercial.

Gulf researchers revealed details on the hammer drill last week. They described it as the answer to two problems facing drillers as well depths go deeper: Crooked holes and hard rock formations which wear out bits and slow up penetration.

Extensive testing of the machine in various areas revealed these achievements:

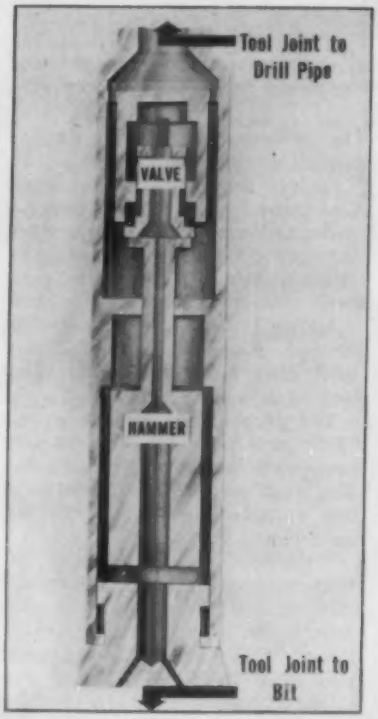
. . . **Penetration rates**—25 to 50 per cent better and in later tests two to four times faster than conventional drilling tools (see chart).

. . . **Bit life**—50 to 300 per cent greater.

. . . **Straight holes** — high penetration speed maintained in hard, slanting formations without excessive hole deviation.

. . . **Maintenance**—60 to 100 hours of consecutive drilling without pulling tool out of the hole for servicing. When this was required, maintenance was quickly accomplished right on the rig floor.

Gulf's director of production engineering and research, E. Topanelian, Jr., says the result is savings in time, maintenance, labor, and supplies—plus a straighter hole.



CUTAWAY VIEW shows mechanical details of Gulf Oil Corp.'s new Type "E" percussion drill.

What it is . . . The hammer drill consists of a reciprocating piston and cylinder for delivering percussion blows to the bit.

Normal drilling mud powers the engine. The fluid is circulated down the bore hole at high pressure. It provides the driving force and also carries off the drilled-up rock.

The device is encased in a cylinder 19 ft. long. It hangs at the end of the drill string. A conventional roller bit is fastened directly below. The circulating mud drives a 200-lb. hammer delivering 600 or more strokes a minute on the attached bit.

Meanwhile, the drill is slowly rotated under a load ranging from 6,000 to 40,000 lb., depending on downhole conditions. The bit points thus are successively positioned and driven against the hole bottom as star drills are turned to make holes in masonry.

Since the percussion hammer hangs almost like a plumb bob at the end of the string, it chops a vertical passage downward despite hardness or slant of the formation.

The conventional bit, by contrast, is attached directly to the end of the drill string and is rotated against the bottom under loads averaging from 25,000 to 55,000 lb. Hence it progresses by chewing or boring into the rock.

Gulf technicians claim these differences account for the hammer drill's success.

What tests show . . . The new drill has been subjected to extensive field and laboratory tests.

In original tests, it drilled more than 6,000 ft. in 32 different holes in West and East Texas, Oklahoma, Nevada, and Canada. It achieved a penetration rate of 25 to 50 per cent more feet per hour than conventional tools. Later in laboratory tests, researchers estimated an improved model will increase penetration through chert, dolomite, and hard limestone by two to four times over present rates.

And in hard, slanting formations, the hammer drill has maintained high penetration speed without excessive hole deviation. In conventional drilling the bit tends to drive off at an angle in these formations. A similar effect can result when the bit goes from one formation to another of differing hardness.

Past practice has been to lighten the string so it hangs vertical and try to avoid crooked holes in this way. But this procedure drastically reduces penetration rate. Since the hammer drill advances by punching, rather than by boring under pressure, its vertical progress is not hampered so much by these conditions.

Field trials also demonstrated that

the new tool can operate 60 hours without being withdrawn for servicing. Recent improvements may extend this time to 100 hours. Also important: When taken from the hole, simple replacements can be made right on the rig and the tool put quickly back to work. The "mud engine" can outlast three or four bits before this servicing is required.

Bit life also is increased by as much as 50 to 300 per cent because percussion drilling does not wear down bits due to running with light loads. In one area conventional bits made only 8 ft. The same type of bit drilled 27 ft. when used with a hammer drill.

Gulf to Use Penex

It'll be first major to put pentane-isom unit into plant

PITTSBURGH. — Gulf Oil Corp. may be the first major oil company to adapt hydroisomerization to its refining program to make very high-octane motor fuels.

The company plans to build a pentane isomerization unit soon, probably on the Gulf Coast. This was revealed recently when Gulf took the wraps off new laboratory facilities at nearby Harmarville.

The new process is ideally suited to Gulf's situation. The company, through Warren Petroleum Corp., has access to extensive quantities of light hydrocarbons. These need upgrading by isomerization before blending to modern gasolines.

The technique, which Universal Oil Products Co. licenses as the Penex process, was jointly developed by Gulf.

Hydroisomerization upgrades the lightest liquid part of straightrun gasoline composed of pentane and hexane *(The Oil and Gas Journal, May 20, page 142).* It chemically rearranges their molecular structure into isopentane and isohexane. The change raises the octane rating of the pentane portion of gasoline stock from around 88 (leaded) to 106. The hexane portion is boosted from a leaded octane number of 65 to 95 or higher.

In present refining when pentane and hexane liquids are blended, they pull down the total octane value of the gasoline pool. The effect is reversed after hydroisomerization. The isopentane and isohexane liquids upgrade the pool's octane number.

The process is so efficient it achieves nearly 100 per cent yield of high-octane fuels from the low-quality charge. Gulf thinks it has a bright future.

Processing briefs

Ethyl Corp. of Canada, Ltd.'s new tetraethyl lead plant at Sarnia, Ont., was formerly opened last week by Rt. Hon. C. D. Howe, minister of trade and commerce. The plant is the first of its kind to be built in the Western Hemisphere outside the U. S. It went into production last September.

Ammonia is looking better, price-wise. Recent advances of $8 a ton have been announced for July 1, the beginning of the fertilizer year. But the synthetic-nitrogen picture is still plagued by over-capacity. Kenneth A. Spencer, president of Spencer Chemical Co., estimates U. S. synthetic-ammonia capacity at 4,123,000 tons per year by 1958-59. This plus supplies from other sources will boost capacity to 4,223,000 tons, roughly 23 per cent higher than estimated consumption for both agricultural and industrial uses.

Lummus Co., Ltd., will build the main process units for the 40,000-bbl. refinery to be built at Whitegate, County Cork. Owner companies awarding the contract were Caltex, Esso Petroleum, Shell Mex., and British Petroleum.

Two more L.P.G. underground-storage projects are in the works in Texas.

El Paso Natural Gas Co. plans 240,000 bbl. of storage cavities in the Salvado salt formation in Ector County. And Tuloma Gas Products Co. wants to add a second 412,000-bbl. whopper in Blue Ridge (salt dome) field of Fort Bend County. Both firms have applications on file with the Texas Railroad Commission. El Paso's 240,000 bbl. capacity would be comprised of four 60,000-bbl. cavities.

Imperial Oil, Ltd., has begun con-struction at its natural-gasoline plant in the Smiley-Coleville area about 120 miles southwest of Saskatoon in western Saskatchewan. The $750,000 plant will have a capacity of 3,000 M.c.f. daily. Brown & Root, Ltd., has the contract for the plant, and Robb Construction Co., Ltd., Regina, has the contract for 10 miles of 4 to 10-in. gathering lines.

Union Carbide Chemicals Co. will build a technical service laboratory on its Westchester County property near Tarrytown, N. Y. The lab, to be completed early in 1959, will serve 24 industries, including petroleum. Union Carbide is a division of Union Carbide Corp.

Davison Chemical Co., a division of W. R. Grace & Co., is offering refiners an alkylated phenol as an antioxidant for gasolines and other petroleum derivitives such as jet fuels and lubricating and diesel oils. The company has two forms, Dav-Ad 101, a 100 per cent 2,6-ditertiary-butyl-4 methyl-phenol, and Dav-Ad 102, a 33⅓ per cent 2,6-tertiary-butyl-4 methyl-phenol in toluene.

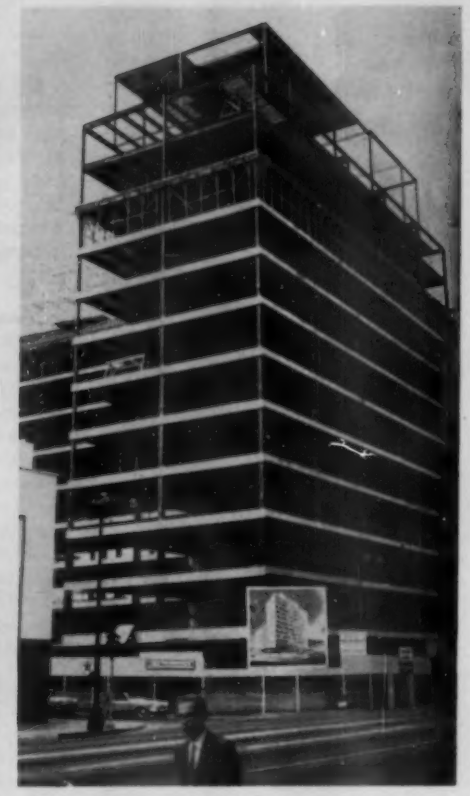
Union Oil Co. has completed a $9,500,000 construction project at its Los Angeles refinery. New units are a 13,000-bbl. Platformer and a 15,750 Unifining unit.

Also for Refiners . . .

Phillips has a formula that ties research closely to company operations. The payoff is plenty of patents (P. 59) . . . Humble plans world's biggest cycling plant near its King Ranch holdings (P. 63) . . . O.C.A.W. expected to step up drive to raid independent unions (P. 74) . . . Serving Europe with liquid methane by tanker is not too far off. Technical and cost hurdles are fast being overcome (P. 66) . . . Air-conditioning units in autos still cut volatility limits of today's gasoline (P. 69) . . . Gulf may become first major refiner to adapt hydroisomerization to its refining program (P. 71) . . . General Motors reveals a new method of measuring vapor-locking tendencies of gasolines (P. 73) . . . Diamond Alkali has doubled capacity of its Deer Park petrochemical plant (P. 73) . . . Texaco is adding a high-powered nuclear center to its Beacon, N. Y. research center (P. 74) . . . Radioactive tracers now have spotted the gasoline components that cause most combustion-chamber deposits (P. 74) . . . Oil industry will have to spend $60 billion in the next 5 years to keep abreast of growing world demand, Texaco Board Chairman Augustus C. Long says (P. 80).

PLUS THESE TECHNICAL FEATURES: First privately-financed butadiene plant is on stream (P. 82) . . . On the Job . . . In the Plants (P. 100) . . . A review of isomerizing pentanes and hexanes with the Iso-Kel process (P. 119) . . . COST-imating (P. 123) . . . PETROdatics (P. 125) . . . The Foreman's Page (P. 126).

UNION OIL CENTER will be Los Angeles' tallest building.



HOME BASE for Texaco's western operations.

Los Angeles Buzzes With Oil Building

SUPERIOR'S new home is adjacent to General Petroleum (left), Richfield (rear).

LOS ANGELES.—California oil production may be declining, but oil-company office-building construction is booming. Three giant structures are being built here, and another was recently completed.

Union Oil Co. of California is spending $20,000,000 for its 13-story Union Oil Center on the west edge of downtown Los Angeles. The 5-acre project includes a three-level underground parking garage for 1,500 cars. Located atop a hill, it will be Los Angeles' tallest building.

The other two buildings are going up on fashionable Wilshire Boulevard. The Texas Co.'s new $3,500,000, 12-story building will house most of Texaco's western operations.

A mile west of Texaco's unfinished building and about 4 miles west of downtown Los Angeles, bulldozers are clearing site for Tidewater Oil Co.'s new national headquarters. The $10,000,000, 6-story structure will have a 10-story central tower initially, and is designed for later expansion to 12 stories or more. It, too, will have underground parking facilities.

And in downtown Los Angeles, Superior Oil Co. recently opened its new 12-story building, across the street from Richfield Oil Corp. and General Petroleum Corp.

New Vapor Yardstick Revealed

ATLANTIC CITY.—General Motors Corp. scientists have come up with a new method of measuring the vapor-locking tendencies of gasoline.

John D. Caplan and Charles J. Brady of General Motors revealed their technique at last week's session of the Society of Automotive Engineers. They said the new test procedure is realistic, accurate, and simple. It answers the need for a better yardstick than the long-standing Reid method.

The G. M. researchers declared their method is useful not only in measuring vapor-locking tendencies of gasolines, but it also can be applied to specific cars to get an insight into their relative tendency to vapor lock.

How it's done . . . The G.M. case is built on a program of testing cars in road performance against various laboratory methods.

When comparing three different fuels in four cars, G.M. researchers found that borderline vapor lock of the three gasolines occurred at Reid vapor pressures varying as much as 1.5 lb.

Fuels of different types with the same R.v.p. did not cause vapor lock at comparable fuel-system temperatures. Similarly, different fuels with different R.v.p. ratings could show the same vapor-locking tendencies in a car on the road. R.v.p., they concluded, is no longer a good index for vapor lock. Its test conditions do not agree with conditions in road performance of passenger cars.

But when vapor pressures were measured in bombs with higher vapor-liquid ratios, the agreement between borderline lock in cars on the road and the modified vapor-pressure measurements became much better for the three diverse fuels.

Bomb designed . . . The G.M. work resulted in a modified vapor-pressure bomb.

The researchers feel this gives a single vapor-pressure reading that is more closely indicative of vapor locking in actual road performance on any gasoline than does the accepted R.v.p. bomb.

In the Reid bomb, the air chamber has four times the volume of the gasoline chamber. The G.M. bomb changes the vapor-to-liquid (V/L) ratio from 4 to 25. This change can be made to a conventional bomb either by filling the gasoline chamber with Woods metal or by cutting it down to 1/25 the volume of the air chamber. This reflects the increase in vapor-handling capacity of modern car fuel systems. If this capacity is radically increased in future cars, they suggest the V/L of the bomb be increased accordingly.

New approach . . . The investigators also looked into the possibility of increasing test accuracy by raising the temperature.

Since vapor lock in cars on the road takes place at temperatures at least 40° to 50° F. higher than the 100° F. bath temperature used for the Reid method, such a change might improve results.

They found, however, that temperature changes had very little effect on the relative vapor pressures of three different types of fuels. The hotter the bath the more difficult it is to handle the bomb. Hence, they decided to stay with 100° F. This permits side-by-side vapor-pressure measurements by both the Reid and G.M. methods.

For their G.M.v.p., the authors named the following advantages:

. . . A single number is easily and rapidly obtained.

. . . It is realistic in predicting how prone the fuel sample will be to cause vapor lock in a car in actual road performance.

. . . Effects of small weathering losses on vapor-locking tendencies of fuels are more accurately measured.

. . . Volatility requirements of the car population can be plotted on distribution curves to determine what percentage of cars on the road will give vapor-locking trouble on fuels of a given G.M.v.p.

. . . Available gasolines can also be plotted on a distributional basis, to guide car designers in adjusting their fuel-handling systems to cope with the spread of fuel types marketed at any given time.

. . . A better comprehension of the vapor locking tendencies of both passenger cars and gasolines by both petroleum technologists and automotive engineers results from expressing these tendencies in G.M.v.p.

Capacity of Petrochem Plant Doubled

HOUSTON. — Diamond Alkali Co. has completed an expansion program which doubles the production capacity of its polyvinyl chlorine plant at Deer Park, Tex.

The unit, shown above, produces a number of polyvinyl chloride resins. End uses of the resins include rigid plastic pipe, vinyl flooring, garden hose, film and sheeting for shower curtains, table cloths, upholstering materials, and many other items.

Diamond Alkali also has doubled the production capacity of perchloroethylene at the Deer Park plant. Production figures were not released.

The Deer Park plastics unit was put in operation in August 1953. Further expansion in the plastics field is now in the planning stage. The company recently announced it will add more monomer production facilities and facilities to produce other types of plastic resins.

Texaco Lab Superhot

● High-powered nuclear center in New York will include three different sources of radiation for oil research

BEACON, N. Y.—Another high-powered radiation laboratory is on the way. This newest entry in a growing field of petroleum research is the facility which The Texas Co. will add to its Texaco Research Center here.

Construction already has started. Completion is slated for next April. The lab will include three different radiation sources:

. . . A 6-million-volt linear accelerator. This unit will be supplied by the Applied Radiation Corp. The device will be the first of its kind in the industry. It will supply high-energy electrons for use in studying their ionizing radiation effects on petroleum fractions and other materials.

. . . A 3-million-volt Van de Graaff generator, built by High Voltage Engineering Corp. This will be used to accelerate charged particles for impingement on target materials for many purposes. It primarily will provide this neutron bombardment to make certain materials radioactive and convert one element into another.

This source also will be used in activation analysis, a new highly specific analytical tool. For example, the process will open to Texaco new possibilities for detecting and measuring the presence of trace poisons on catalysts and trace metals in crude and products. It will also permit identification of some unknown compounds occurring in crude oil and converted petroleum fractions.

. . . Cobalt 60 pencils with a radioactive strength of 35,000 curies. These pencils are ½-in. diameter and 11 in. long clad in stainless steel for corrosion protection. They will be brought to full strength by 3 years of soaking in the Canadian Chalk River national research experiment reactor.

The cobalt-60 source will be stored under water in a pit beneath the hot cell. It will be withdrawn and maneuvered by master-slave manipulators from shielded positions to give the desired gamma radiation on petroleum components in miniature processing units. The choice of cobalt-60 pencils will allow varied configuration to meet the needs of many processes to be investigated.

Old hand at hot stuff . . . Texaco is no stranger to nuclear research.

Company scientists were working with radioactive isotopes before the advent of the first nuclear reactor. They have extended their experience in this field at the Brookhaven, Argonne and Oak Ridge national laboratories, the University of Michigan, the University of Rochester and other study centers.

"We will increase our radioisotope investigations that bear on day-to-day problems in the use of lubricants and fuels," said Frederick H. Holmes, vice president in charge of the company's research and technical department. "Our researchers hope to enlarge their understanding of how greases and oils lubricate, how wear and corrosion occur, why certain jet fuels are better than others, and other related problems," said Holmes.

The laboratory will have four main areas: the high-level radiation area, the laboratory area including the hot labs, the office area, and the service area.

Texaco scientists cooperated in engineering the radiation laboratory with the Vitro Engineering Division of Vitro Corp. of America. Construction will be by W. A. Berbusse, Inc., of New York.

Basin Test Dry

Shell quits deep Delaware wildcat after 17 months

KERMIT, Tex.—West Texas has lost another chance for production from the deep beds of the Delaware basin.

Shell Oil Co. has abandoned its 1 University "17-A" in southwestern Winkler County at a total depth of 17,410 ft. Total drilling and testing time was 17 months and 11 days.

Shell's test was near the rim on the east-central side of the basin, but it was far enough out in the basin to find the Devonian at 17,260 ft. Just finding the pre-Pennsylvanian formation markers added to the little-known geology of the basin.

Geologists have suspected that a complete section of pre-Pennsylvanian beds underlies the Delaware basin, but the depths of these beds plus the difficulty of securing satisfactory seismic interpretations has made exploration slow and expensive. Only the majors could take an interest in it.

The Shell well had a complete section and was identified down to and including the Devonian. In addition, the well had gas shows throughout the Permian and made several heavy flows of gas and condensate through the Pennsylvanian.

For a time the well looked like a commercial producer. Drill-stem tests produced gas estimated up to 7,000,000 cu. ft. daily, and one test, around 14,000 ft., gaged 2,430,000 cu. ft. of gas and 147 bbl. of condensate in 12 hours. In almost all cases, the flow gradually died or turned to salt water, even after extensive acid treatment.

The test is 6 miles southwest of Wink, 2¼ miles southwest of a gas producer from the 6,100-ft. level, and 10 miles southwest of Devonian and Ellenburger gas-distillate production in Emperor field.

Dirty Fuel Spotted

High-boiling hydrocarbons given blame for deposits

ATLANTIC CITY. — Radioactive tracers have put the finger on gasoline components causing the most combustion-chamber deposits.

Reporting before the S.A.E. summer meeting here, L. B. Shore and K. F. Okert of Esso Research & Engineering Co. declared high-boiling hydrocarbons are the culprits. The heavier aromatics like hexyl toluene, naphthalene, propyl toluene and indane are especially bad actors. So are olefins and paraffins, in that order, boiling above 600° F.

This new approach brings specific and reproducible proof of the bad effects of these dirty-burning gasoline components. Selected suspects were synthesized in the laboratory with one carbon atom per molecule comprising radioactive carbon-14. They were then added to a balanced gasoline in minute quantities of 1 to 2 parts per million, so that the tagged fuel remained representative of commercial product.

After use in conventional engines, deposits were carefully collected from various areas of the combustion chamber. These deposits then were burned to CO_2 which was carefully collected and scanned for its concentration of the carbon-14 content. The ratios of carbon-14 to nonradioactive carbon in the fuel and in the deposits, then gave a relative measurement of the contribution of the individual component to deposit formation.

Esso went further in its study of the mechanism of deposit formation. Studies showed that the carbon in combustion chamber deposits appears to form via a mechanism involving condensation of the heavy-boiling components followed by carbonization.

BEHIND DOPE MACHINE, 34-in. pipe is cradled into ditch as . . .

Trans-Canada Resumes Work

REGINA, Sask.—Trans-Canada Pipe Lines, Ltd., is off to a running start this spring on its gas line from Alberta to Montreal.

To offset the short construction season, some pipe was double-jointed into 80-ft. sections and strung along the frozen, snow-covered right-of-way during the winter.

Sections 1 and 2, totaling 225 miles from Alberta to Pense, Sask., were completed last year.

Mannix, Ltd., has started on all phases of construction at Pense, 13 miles west of Regina. The contractor cut a ditch 4 ft. deep while frost was still on the ground, and followed with two other ditchers to deepen the trench to 6 ft.

Other contractors, delayed by the spring thaw which kept heavy equipment off the roads, started up after Mannix. The line will be completed to Winnipeg this September when Dutton-Williams Brothers, Ltd., Price-Poole of Canada, Ltd., and Canadian Bethel, Ltd., wind up spreads 4, 5, and 6.

Majestic Contractors, Ltd., is clearing and grading section 7, an 85-mile, 30-in. stretch from Winnipeg to the Manitoba-Ontario border. Clearing, grading, and other preliminary work are in progress from this point to Port Arthur, Ont., on the 310-mile, 30-in. section being built by Northern Ontario Pipe Line Crown Corp. Spreads on this crown-corporation segment were let to Dutton-Williams, Morrison-Shivers, Ltd., Majestic, and Houston Contracting Co. *(The Oil and Gas Journal, May 20, page 127).*

Trans-Canada will begin gas service from the Alberta-Saskatchewan border to the lakehead at Port Arthur late this year. The 310 miles of 20-in. from Toronto to Montreal and a 33-mile, 24-in. line to connect with Trans-Canada's Niagara-Toronto line will be built this year to import U. S. gas pending completion of the all-Canadian line.

The Port Arthur-Toronto gap will be bridged in 1958, completing a 2,250-mile gas pipeline, the world's longest, with initial capacity of 300,000,000 cu. ft. per day. This can be doubled by increasing compressor horsepower.

West Texas Wells Sold

DALLAS.—Marion H. Stekoll of Stekoll Properties, Dallas, has announced purchase of 60 producing wells in Dorward and Justiceburg fields of Garza County, West Texas.

Purchase price was about $2,500,000. The wells have an allowable of 1,200 bbl. daily. They were owned by U. M. Harrison, D Y. Gorman and Viola Louise Gorman, Houston, and Cullihan Interests, Inc., Abilene.

Stekoll was joined in the purchase by Fred Fox and Associates of Philadelphia and New York. The wells are located about 25 miles north of Scurry County reef fields.

—— *Industry* briefs

Farmers Petroleum Cooperative, Inc., of Lansing, Mich., has acquired interests in 28 producing wells on 18 leases in Reynolds pool of Montcalm County, Michigan, for $2 million. Seller was Swan-King Oil Co. Lease Operating, Inc., of Mount Pleasant has assumed supervision of operations.

Producing Properties, Inc., Dallas, has bought a 31/64th working interest in two tracts of the SACROC Unit in Kelly Snyder field, Scurry County, West Texas. The company paid $200,000 to E. E. Fogelson and Gibraltar Oil Corp., Dallas, for the interest.

Utah is the newest member of the Interstate Oil Compact Commission. Gov. George Dewey Clyde recently signed the compact, making Utah the twenty-seventh member state. Four associate member states make a total of 31 pledged to oil and gas conservation.

Shell Oil Co. has set a new drilling-depth record for Nebraska at the 2 Schneider "L" in Heidemann field, Kimball County. The well was bottomed at 8,875 ft.—11 ft. deeper than the Pan American Petroleum Corp. 3 Lovercheck in Banner County, which had held the record since 1952. The Shell well was completed for 281 bbl. daily from the Dakota-Cretaceous sands at 6,259-63 ft. Both the Shell and the Pan American wells are in extreme western Nebraska.

Felix E. Wormser, assistant secretary of the interior for mineral resources, resigned last week to return to private life. He will leave the Government June 15 after serving 4 years. He was in general charge of the Office of Oil and Gas, Bureau of Mines, and other Interior agencies dealing with minerals.

The Texas School Land Board will take in more than $5,000,000 from its last week's sale of oil and gas leases. Oil companies submitted high bids totaling $5,122,792 for leases on 152 of the 274 tracts offered. Most of the acreage was submerged lands. A large portion of it is in the Gulf of Mexico.

Union Oil Producing Co. was top bidder at the auction, offering $224,320 for each of four 640-acre blocks in the Laguna Madre. Continental Oil Co. offered $201,606 for a 640-acre tract in Baffin Bay. And Humble Oil & Refining Co. latched on to another 640 acres in Galveston Bay for $193,984.

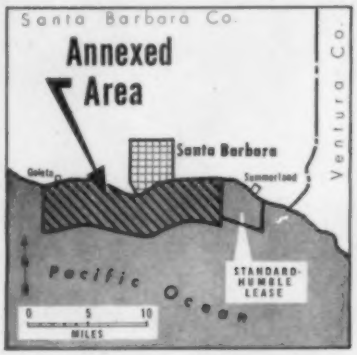
Santa Barbara says keep out:

City Annexes Offshore Area

SANTA BARBARA, Calif.—The city of Santa Barbara has annexed a chunk of the Pacific Ocean to keep oil development away from its fancy residential and recreation areas.

The annexed area takes in all 49 sq. miles of the offshore oil sanctuary created by the Cunningham-Shell Act of 1955. It stretches 3 miles seaward and extends from the Standard-Humble offshore lease at Summerland to a point just west of Goleta (see map).

The annexation was an emergency measure adopted by the city council in a race with the Santa Barbara County government. The county had sponsored a bill in the state legislature to limit the city's annexation to that offshore land between the city's lateral boundaries. The county-sponsored bill was on the floor of the senate when the city council acted.



What's behind it . . . Behind the scrap is this wealthy city's effort to prevent oil development in plush residential and recreation areas on the seacoast.

Under terms of the oil sanctuary set up in the Cunningham-Shell Act, the state can offer the offshore oil sanctuary for drilling only if there is drainage from onshore wells. The county contended this is protection enough for onshore estate owners who could prevent onshore drainage by simply not letting anyone drill on their land. But the city wanted annexation as "further protection" against drilling.

Now, Santa Barbara has one of the strangest boundaries in the nation, with 18.92 sq. miles onshore, and 51.76 sq. miles of Pacific Ocean.

Here's how Santa Barbara was able to scoop up such a large offshore area:

An incorporated city in California can annex contiguous territory, if it has holdings within the territory to be annexed worth more than 50 per cent of the total area. In this case, Santa Barbara had an airport in the small onshore portion annexed along with the huge offshore area. The city claims the airport is worth $5 million while the entire annexation was worth $7.5 million. The city has the right to set values on land involved.

One other feature of the state annexation laws says the inhabitants must agree to the action. In this case, of course, the area is not populated.

Summerland lease . . . The eastern end of the annexed offshore oil sanctuary adjoins the Standard Oil Co. of California-Humble Oil & Refining Co. 5,500-acre offshore lease at Summerland. The two companies paid $7,250,000 for the wildcat lease.

Standard, as operator on the lease, was drilling below 3,950 ft. on its second core hole there.

Texas high court ruling means . . .

Bay Area Wells Face City Tax

TEXAS CITY, Tex.—Producers in the Dollar Bay and Moses Lake areas near Texas City in Galveston Bay have been hit a hard tax lick.

The Texas Supreme Court has upheld Texas City's right to annex the submerged lands—and thus its right to tax oil produced from them.

The land in question, comprising about 2,000 acres of the 3,500 acres annexed, is owned by the State of Texas. The state in turn leased mineral rights to Pan American Production Co. and other producers.

The Supreme Court ruling upheld previous decisions by the Galveston District Court and the Galveston Court of Civil Appeals.

It ruled 5 to 4 that an annexation by a city isn't subject to a judicial review if the territory in question is "adjacent" to the city and not within the bounds of any other municipality.

The losers' argument . . . The state joined the producers in challenging the annexation. They contend that it should be voided because the city's sole reason for annexing was to tax the producers' property.

The losers argued that the territory is uninhabited and unfit for habitation. It has no water-borne traffic. Therefore, it has no need for municipal services. Texas City, they contended, has no good-faith intention of using the land for municipal purposes nor of furnishing municipal service.

Four Supreme Court justices strongly dissented from the majority opinion. Relying on a U. S. Supreme Court decision in a case involving a Louisiana drainage district, they contended that annexation solely to tax and without any need of the annexed land for municipal service is illegal. It deprives property owners of their property without due process of law—thus violates the Fourteenth Amendment of the Constitution.

They said the case should have been remanded to the District Court with instructions to determine the city's purpose in annexing the territory.

Drilling Tees Off

Los Angeles approves plan for wells on golf courses

LOS ANGELES.—The city council last week approved drilling on the 180-acre city-owned Rancho golf course and the 144-acre privately owned Hillcrest Country Club in exclusive West Los Angeles.

Both golf courses adjoin the 20th Century Fox movie lot where Universal Consolidated Oil Co. has been drilling and producing successfully for several years.

The council's approval took the form of a vote to have the city attorney prepare ordinances creating drilling districts at both courses.

Earlier in the week, Signal Oil & Gas Co. and Richfield Oil Corp. topped bidding for drilling rights to Rancho with a joint cash offer of $417,685 plus royalty. Edwin Pauley, independent oil operator, filed the only other bid with the City Recreation and Parks Department. His was for $390,900.

Signal had previously signed up drilling rights to the Hillcrest acreage.

Both Signal-Richfield and Pauley submitted similar royalty proposals. They called for a guaranteed 20 per cent of the gross revenues until development costs, including the bonus, are paid for, and a sliding scale between 50 and 80 per cent of net production thereafter. If no oil is found, the city can keep the $417,685 anyway.

Under terms of the proposed ordi-

nances, the city zoning commissioner will have final say on drill sites which must meet strict soundproofing and landscaping rules. The council also ordered an ordinance drawn permitting slant drilling on about 40 acres Signal has under lease adjoining Hillcrest.

Alberta Loses Out

Low tanker rates blamed for Canadian market loss

CALGARY. — Cheaper tanker rates were blamed by some oil companies for the cut in Alberta's June allowables.

The Alberta Petroleum and Natural Gas Conservation Board set the allowable at 418,703 bbl. daily—16,981 bbl. lower than the May figure.

Refineries in northern California requested only 15,000 bbl. daily during June, which is 40,000 bbl. below the May nominations.

At the same time tanker rates have dropped considerably, which would permit southeastern Asiatic and Middle Eastern crude to be brought in to California at a cheaper rate. Spot rates for tanker fixtures have dropped from USMC plus 200 per cent early in March to USMC minus 40 per cent early in June.

Alberta's June allowable is estimated to be about 50 per cent of what the province's 7,600 wells could produce if permitted to produce at maximum efficient rates.

It was considered doubtful here that the U. S. administration's recent crackdown on oil imports had anything to do with the Alberta market.

Reiter-Foster Closes Deal

DALLAS.—Reiter-Foster Oil Corp. last week paid $1,675,000 in cash and oil from Texas and Oklahoma to acquire properties of Advance Petroleum Corp., Dallas, and the production of Carl J. Westlund, Inc., Midland, Tex.

Reiter-Foster gets production on 27,415 gross acres in Texas and Oklahoma, four drilling rigs, and a 34 per cent interest in 640 acres of uranium claims near Grants, N.M.

Westlund's production was in Ector, Sterling, Reagan, Gaines, and Glassock counties in West Texas. Advance owned production in West and North Central Texas and Oklahoma.

There are 57 oil and gas wells on the properties. Reserves as of March 1, 1957, were estimated at 1,950,000 bbl. of oil and 2,000,000,000 cu. ft. of gas.

Pipeline briefs

Gas produced in Texas' big Panhandle field now is bringing an average weighted price of 10.8187 cents per M.c.f., the Texas Railroad Commission revealed last week. The price is for gas at a base pressure of 16.4 psia. and at a standard base temperature of 60° F. The commission reported its survey also shows that it costs about 0.5 cent per M.c.f. to sweeten the Panhandle's sour gas.

A 92-mile segment of Interprovincial Pipe Line Co.'s 156-mile, 20-in. extension from Sarnia to Toronto is being handled by a joint venture of Robert Somerville Co., Ltd., and Sheehan Constructors of Canada, Ltd. This is the first Canadian venture for Sheehan, a Tulsa contractor. The Somerville-Sheehan spread extends from Sarnia to Bright. Majestic Contractors, Ltd., is building the remaining 66 miles on the 111,000-bbl.-daily extension.

Plains-Western Gas & Electric Co. is building a 25-mile, 10-in. lateral line from Trans-Canada Pipe Lines, Ltd., to the city of Brandon, Man. The project is contracted to Fulton Banister, Ltd. The city should be receiving gas service by September.

Texas Eastern Transmission Corp. and affiliated companies plan a $30-million expansion of natural-gas facilities. Federal Power Commission authority has been sought to increase capacity to handle an additional 112,-203,000 cu. ft. daily of long-term firm gas and 83,804,000 cu. ft. of winter peaking gas for 1957-58.

Texas Eastern plans 96.5 miles of 30-in. loop between Kosciusko, Miss., and Uniontown, Pa.; 40 miles of 10-in. supply laterals; a new 10,250-hp. compressor station near Mount Belvieu, Tex.; 31,160 hp. at existing stations between Beaumont and Kosciusko; and 2,200 hp. at Linden, N. J. Texas Eastern Penn-Jersey Transmission Corp. plans to add 24,000 hp. at stations between Oakford Storage field, in Pennsylvania, and Lambertville, N. J.

Permian Basin Pipeline Co. has agreed to sell up to 200,000,000 cu. ft. of gas daily to El Paso Natural Gas Co. in Lea County, New Mexico. Permian explains the sale is necessary to balance the rate of take from Lea County wells connected to the Permian and El Paso systems. Since gas proration went into effect El Paso's market needs have exceeded allowables. The reverse has been true for Permian. Federal Power Commission authority is being sought for the sale, which would continue as long as the market situation dictates.

Montana-Dakota Utilities Co. will be able to take additional gas from its Tioga reserves in North Dakota when newly approved facilities are completed. The Federal Power Commission authorized 28 miles of 12-in. main line from Fallon County to Dawson County, Montana; 660 hp. at its Cabin Creek, Mont., station; and 1,080 hp. at Baker, Mont.

United Gas Pipe Line Co. expects to complete a 40-mile, 20-in. gas line from Grand Chenier to Lake Charles, La., this week. The line will transport gas from Deep Lake field to United's main line. The line was built by Brown & Root, Inc.

Pacific Northwest Pipeline Co. is completing cleanup work this week on a 92-mile 26-in. section of its gas line from Sumas to Snohomish, Wash. Cape Construction Co., Inc., has the cleanup contract. The line, from the San Juan basin to the Canadian border, has been operating several months.

Also for Pipeliners . . .

House committee is preparing the Harris gas for the House floor but members are still in dark on administration intentions (P. 62) . . . Right-of-way ruling favors pipelines in Texas. Humble plans a pipeline network along with a big cycling plant to bring first gas to market from King Ranch (P. 63) . . . Trans-Canada is off to a running start on warm-weather work on its big line from Alberta to Montreal (P. 75) . . . Caltex has completed a new pipeline and other facilities to help move crude from its Minas field in Sumatra to terminal (P. 80) . . . The French plan a small-diameter pipeline as a temporary outlet for oil discoveries in the Algerian desert (P. 80).

PLUS THESE TECHNICAL FEATURES: How Stanvac pipelines Sumatran crude with a pour point of 110° F. (P. 89) . . . Pipeline Patrol: Construction Tables (P. 135).

Bolivia Perking Up

Country asks bonus and oil-payment bids on tax-free deal near production; McCarthy negotiating sale of concession

AN EARLY UPSWING in activity in Bolivia is in prospect as a result of three developments last week.

In rapid succession:

. . . Bolivia asked U. S. companies to bid on a 108,200-acre concession near the Argentine border.

. . . Glenn McCarthy revealed he is negotiating to sell his Bolivian interests to a recently formed combine specializing in foreign ventures.

. . . Bolivian Gulf Oil Co. disclosed it has shipped a heavy-duty rig with which it will drill the first wildcat on its 3,750,000-acre reservation.

Bolivia called for bids on an area involving three anticlines. It asked companies to offer a percentage of the oil found and cash bonuses in lieu of government taxes.

The area is just north of the Argentine border and adjacent to the Glenn McCarthy concession. The announcement (page 194) said oil has been found on the Yacuiba anticline on the Argentine side of the border. McCarthy reportedly has found both oil and gas on his concession.

The Bolivian bid invitation offers a 35-year concession on the 108,000-acre area. Companies are asked to bid:

. . . A percentage of the first 50,000,000 bbl. of oil produced, plus a higher percentage of each additional 10,000,000 bbl.

. . . A cash bonus, either in lieu of or an addition to the oil payment.

. . . A percentage of the production of natural gas and its derivatives.

In addition, companies must offer cash advances to Yacimientos Petroliferos Fiscales Bolivianos, the government oil agency. These advances will be forfeited if no oil is found but will be repaid out of the government's royalty oil if commercial production is developed.

The McCarthy deal . . . Prospective purchaser of Glenn McCarthy's interests is T.U.L.M. Corp., Houston.

It was organized recently by Tennessee Gas Transmission Co., Union Oil & Gas Corp. of Louisiana, Lion Oil division of Monsanto Chemical Co., and Murphy Corp.

The firm has acquired an option from the Bolivian Government on the McCarthy concession. It also has entered into a contingent contract with McCarthy to acquire all of his rights and claims in the concession.

Tennessee Gas, with a 35 per cent interest in the deal, has been named operator for the four companies. Operations would be conducted through a newly formed T.G.T. subsidiary, Chaco Petroleum S.A.

The original McCarthy concession, obtained 5 years ago, covered about 970,000 acres. Half interest later was sold to a syndicate headed by a New York firm. McCarthy has drilled four wells and reportedly has found both oil and gas.

The famous Houston wildcatter has contracted to sell more than 50,000 M.c.f. per day of Bolivian gas to two Chilean mining companies. However, the sales are contingent on construction of a 500-mile pipeline from the Bolivian field to Chile. Cost of the pipeline has been estimated at $30,000,000 to $35,000,000.

T.U.L.M. was organized recently with Earle F. Taylor as president *(The Oil and Gas Journal, March 4, page 83).* Taylor was formerly in charge of foreign operations for DeGolyer & MacNaughton.

The Bolivian deal is the second South American venture by the Tennessee - Union - Lion - Murphy group. The same firms recently obtained an interest in a concession in Venezuela's Lake Maracaibo.

Wildcat scheduled . . . The heavy-duty rig en route to Bolivia is scheduled to spud Bolivian Gulf's first wildcat by late summer or early fall.

The first well will be drilled at Mandeyapecua about 18 miles east of Boyuibe, the northern terminus of a railroad which runs north into Bolivia from Argentina. The drill site is about 90 miles north of the Bolivia-Argentina border and is about 50 miles southeast of Camiri, the country's main producing field.

Arnold Hatfield, division petroleum engineer for Gulf Oil Corp.'s Houston division, will be in charge of the drilling program. The well will be drilled with company crews. A National 130 rig will be used.

The region to be tested lies in the southeastern zone of Bolivia that was reserved to Y.P.F.B. under terms of the country's new oil law.

Gulf signed a contract with the government last year which grants it exploratory rights over 3,750,000 acres in this area. At any time within 4 years the company can choose 1,125,000 acres to develop under a 40-year exploitation contract *(The Oil and Gas Journal, April 2, 1956, page 91).*

In addition to this reserved land

contract, Gulf was granted another 4 million acres outside the Y.P.F.B. zone under a straight exploration concession. A 20 per cent interest in the Bolivian Gulf operation is owned by three Tulsa firms, Williams Brothers Sudamericana, Ltd., Falcon Seaboard Drilling Co., and Berry & Reiner, Inc.

Sumatra Area Grows

New pipeline and barges help move Minas output

CALTEX has completed the first part of its extensive development program in Central Sumatra.

This included additions to Minas field production and offtake facilities, and the opening of a 16-mile, 18-in. crude pipeline connecting the main Minas pumping station and Perawang terminal on Siak River.

The new line parallels the original 12-in. line and more than doubles the offtake capacity. The company's Indonesian subsidiary also doubled, from 6 to 12 the number of river tankers used to carry crude from Perawang 93 miles down river to the ocean terminal at Pakning.

Production climbs . . . Minas accounts for virtually all Caltex production in Indonesia. Output has risen to more than 135,000 bbl. daily, compared with about 88,000 bbl. daily last year.

Other parts of the over-all expansion program include full-scale development of Bekasap and Duri fields, about 40 miles northeast of Minas. A 30-in. crude line will link the two fields with a new deep water terminal at Dumai. Eventually, Minas will be tied to this line *(The Oil and Gas Journal, April 1, page 98)*.

Italy to Make More Rubber

ANIC, of Milan, Italy, will increase the capacity of its synthetic-rubber plant under construction at Ravenna by 20,000 metric tons per year. Butadiene for the added capacity will be obtained from butane.

The Ente Nazionale Idrocarburi subsidiary originally planned to produce 35,000 tons per year of GR-S synthetic rubber, along with nitrogen fertilizers. Butadiene for this portion of the output will be made from methane. A Union Carbide process will be used, with acetylene and alcohol as intermediate steps.

Phillips Petroleum Co. designed the copolymerization process. Styrene will be made by a Koppers Co. process.

French Plan Line

Small-diameter temporary outlet planned in Algeria

A 6 TO 10-IN. line from Hassi Messaoud field to the rail head at Touggourt apparently will be the first step toward a pipeline outlet for oil discoveries in the Algerian desert.

The line, to start perhaps this year, will probably be built under the name of Saharian Pipe Line Co., a subsidiary of Cie. Francaise des Petroles (Algerie), a French Government company. Capacity of the 100-mile temporary line will be 10,000 bbl. per day. From Touggourt the oil will be transported by tankcar to Philippeville, on the Mediterranean coast.

In the meantime Hassi Messaoud output is being trucked to the railroad.

Within 2 years, the French company will consider building a 412-mile line from the field to the Mediterranean. Diameter would be in the range of 20 to 24-in. for capacity of 200,000 to 300,000 bbl. per day, depending on development success. A 5-mile stepout northeast of the field discovery apparently has encountered the same pay and the French are greatly encouraged by the prospects *(The Oil and Gas Journal, May 27, page 107)*.

The French expect Hassi Messaoud and Edjele field, near the Libyan border, to be producing 95,000 bbl. daily by the end of the year. A 10-in. line from Edjele to Touggourt was announced earlier.

The big-inch line from Hassi Messaoud may be of aboveground restrained-line construction except for the north and through mountainous terrain and cultivated areas. There it would be buried.

Restrained-line construction was originally devised for the Trans-Arabian Pipe Line completed in 1950. Long straight sections of pipe are supported on short concrete piers and restrained at intervals by heavy concrete anchors.

Maximum elevation for the line will be 1,060 meters in the Atlas Mountains 85 miles from the coast.

Thick Pay Sand Logged

VENEZUELAN Atlantic Refining Co. has logged 690 ft. of prospective oil sands in a test 3½ miles northwest of Santa Barbara field in Monagas.

The log was run in the Pirital 4. Sidewall cores indicated 18°-gravity oil. Encouraged by these signs, Varco deepened the hole to the limit of the rig—3,501 ft. A log to this depth also looked good.

The well was waiting on cement late in May. Since it was drilled with fresh water, water blocking might make testing difficult. The upper part of the well reportedly was badly washed out.

The 600-ft. pay is unusually thick for most of Eastern Venezuela. The exceptions are Quiriquire and some parts of the Greater Oficina area.

The Varco location is surrounded on three sides by Mene Grande Oil Co. acreage. The Bosque 2, a Mene Grande wildcat about a mile north east of the Pirital 4, was abandoned last month as a dry hole.

Italy Has New Pay

Second zone discovered on old Gulf concession

WHEN GULF OIL CORP. pulled out of Italy in protest against what it calls the unfair terms of the country's new oil law, it left behind what may still be the best oil field yet found on the Italian mainland.

Recently, Gulf's former partner, the far-flung Montecatini chemical interests, completed the first well in Cigno ("Swan") field since Gulf left the operation. Preliminary and still incomplete reports on the well, Cigno 7, indicated it is being completed in a second pay zone which is more than 300 ft. deeper than Gulf's discovery in January 1955.

Reports from Italy said the well found a new pay zone at 2,624 ft. It is located only a little more than 1,600 ft. from two wells being drilled by AGIP-Mineraria, an Italian Government company.

After the January 1955 discovery by the Gulf-Montecatini company tested at least 2,000 bbl. of oil daily, the government-owned companies flocked to the Abruzzi region of Italy's Adriatic coast east of Rome to spud wells near the privately held concession.

The first two Cigno wells drilled by Gulf were later shut in because of water encroachment. If the flanking wells drilled by subsidiaries of Ente Nazionale Idrocarburi have had the same trouble in Abruzzi, the government companies have not talked about it.

Montecatini Societa Generale per l'Industriat Mineraria e Chimica, which has taken over the Cigno operation, has asked the Italian Government for the production permit which was always refused the field while Gulf headed the operation *(The Oil and Gas Journal, April 1, page 99)*.

Oil Spending to Double

● Texaco chairman sees Middle East playing a bigger role in world oil as demand soars to new records

THE CHAIRMAN of one of the world's biggest oil companies says the industry will spend $60 billion in the next 5 years to keep abreast with growing world demand.

Augustus C. Long, chairman of The Texas Co., made this prediction last week while speaking before the New York Chamber of Commerce.

Long's estimate places oil expenditures during the next 5 years at almost double the rate of the past 10 years. Since 1946 the industry has made capital expenditures of $62 billion with $42 billion being spent in the U. S. and $20 billion abroad.

In his 5-year forecast, the Texaco executive said half of the money will be poured into foreign oil ventures. But Long warned that the "political and financial climate" both in the U. S. and abroad must be favorable before international companies will invest such large sums abroad.

Long said "no competent management" will risk stockholders' funds in a country whose record is "stained by broken contracts and instances of bad faith." But at the same time, a proper attitude is needed in the U. S.

"If American industry is to invest abroad, it must be encouraged to do so by recognition here at home of certain basic factors pertaining to foreign operations. It must be recognized that such operations are long-range, that they are filled with risk, and that the road to profits is often paved with disappointment."

Long said many people think foreign operations are making exorbitant profits because foreign oil is "cheap" oil.

"Anyone in the industry who has producing operations abroad can tell you that this is far from the case. The problem is to earn enough to provide stockholders with a reasonable return on their investment and at the same time help provide the increasingly large funds needed for capital expenditures in this country and abroad," he said.

Demand . . . Long sees some big gains in the world demand for oil.

Here's the way it looks to him:

. . . Domestic demand is expected to reach approximately 12.1 million barrels a day by 1965—or almost 40 per cent above the present level. He said U. S. demand by 1960 will be up to about 10.3 million barrels daily. Last year, U. S. demand was 8.8 million barrels daily, he said.

AUGUSTUS C. LONG
. . . places oil's 5-year spending at $50 billion

. . . Free-world demand outside the U. S. is expected to increase almost 115 per cent over the current level by 1965, reaching nearly 14.6 million barrels a day. In 1960, this demand will be 9.8 million barrels daily. Last year, free-world demand outside the U. S. was 6.8 million barrels daily, he said.

"Since it is difficult to visualize this tremendous growth in terms of barrels of oil, let me put it another way. By 1965 the free-world consumption of petroleum will have rises roughly five times the level prior to World War II."

Source of crude . . . The increasing demand underlines the importance of Middle East crude, according to Long's remarks. He said foreign production—primarily the Middle East—will meet most of the increase in demand.

He pointed out the U. S. share of free-world reserves slipped from 39 to 17 per cent during 1946 to 1956 and said they will continue to slip.

"While our reserves have consistently increased since the war, they have done so at a slower rate than both domestic production and domestic demand. Last year, for example—a year of record producing activity in this country—we consumed six times as much oil as we discovered in new fields. At the end of the year, our reserves were equivalent to only 11 years' demand—the lowest reserve-demand ratio since these calculations were first published in 1936."

He said conservative estimates of Eastern Hemisphere reserves show they have quadrupled since World War II and now account for 75 per cent of the free-world total. Western Hemisphere reserves have jumped 60 per cent since the war, but only account for 25 per cent of the free-world total.

"It is estimated that the Persian Gulf area has about three times as much oil as the rest of the free world combined. In looking at the world oil picture, then, as things stand today you simply have to face the fact of the dominating position held by Middle East reserves."

India Starts Test

Well marks government's debut in oil exploration

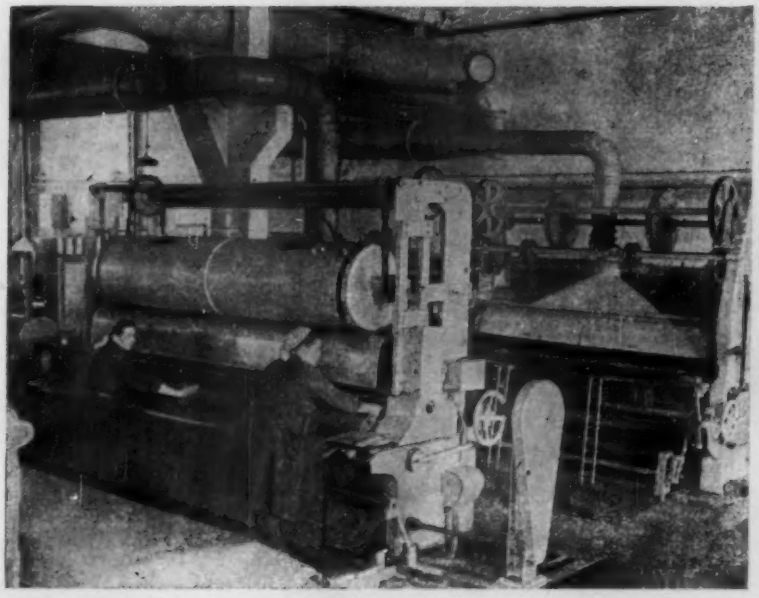
THE INDIAN Government's first wildcat is almost within the shadow of a natural-gas flame which has burned in honor of a Hindu goddess for countless centuries.

The well, at Jawalamukhi in the Kangra Valley of Punjab, marks the government's first attempt at oil exploration under its own power. It is 1,000 ft. uphill from a temple built around a gas flame regarded as sacred.

The well also is the first known to be drilled in the free-world area by a crew from a Russian-controlled country. Romanian drillers are operating a Romanian-built rig set up on a 3,000-ft. spur of a hill in the Shivalak range. Projected depth of the test is 11,000 ft.

On the eastern side of India, Assam Oil Co. has completed its twenty-seventh well in Assam Valley since the Nahorkatiya discovery 4 years ago. Crews of the Burmah Oil Co. subsidiary have reduced drilling time on the 11,000 to 12,000-ft. development wells to a month or less when there is no down-hole trouble.

Nahorkatiya is rated better than 50,000 bbl. daily. But it is shut in pending the formation of new producing and refining companies in which the government will participate. An agreement was reached in regard to a producing company last month. Arguments over formation of the refining company and the location of the refinery site remain unsettled.



Paper Pipe: Russian women workers are making paper pipe for the Soviet oil industry. The pipe is made from paper impregnated with a special resin and is formed at a laminated-plastics plant at Leningrad. The Soviet ministry of the oil industry reports the pipe is five times lighter than metal, is not subject to corrosion, and is very durable. It is used in oil-well production instead of metal pipe which is an item in critical supply.

Middle East Price Hike to Stick

THE PRICE INCREASE on Persian Gulf crude seemed a sure thing to stick last week, but the big question was: How much will it be?

Moves within a few days by three companies to meet the B.P. Trading, Ltd., increase of 13 cents per barrel erased any doubts that the price would stay up.

But the first posted increase for Saudi Arabian crude at Ras Tanura was 17 cents. This indicated the 13-cent boost was not being automatically followed across the board.

If the higher price holds, it will be better news for United States producers. Persian Gulf imports to the East Coast would be less attractive than they are now. Domestic crude prices also would become much more firm.

This price action followed closely the 1953 crude increase in the Presian Gulf. At that time prices fluctuated for 10 days before a 22-cent raise was settled upon.

The increases . . . Here is how companies lined up after the British Petroleum Co., Ltd., subsidiary raised prices on May 28 for crude exports from Iran, Iraq, Qatar, and Kuwait.

. . . Shell Petroleum Co., Ltd., a part of Royal Dutch-Shell, raised prices 13 cents on May 30. Shell Petroleum has crude available for exports from the same countries as B.P. except Kuwait.

. . . Gulf Oil Corp. subsidiaries made their 13-cent raise on June 4. These were Gulf Kuwait Co. in Kuwait, and Gulf International Co. in Iran.

. . . Standard Oil Co. of California subsidiaries then followed with diversified prices. Socal's California Transport Co. met the 13-cent increase for its share of Iranian crude. But it posted a price increase of 17 cents for Saudi Arabian crude at Ras Tanura.

Besides being the first raise past 13 cents and the first raise posted at Ras Tanura, the posting was the first listing at Ras Tanura by California Transport.

The Caltex company, Mid-East Crude Sales Co., Ltd., in which Socal has half interest, continued for the time being to list old price at Ras Tanura.

. . . Remaining majors in the Middle East were in a wait-and-see position, deciding on whether the 13 or 17-cent price or a listing in between, had the best chance of holding. They are subsidiaries of Standard Oil Co. (N. J.), Socony Mobil Oil Co., Inc., and The Texas Co.

———World briefs

Aden will become the world's leading bunkering port when Standard-Vacuum Oil Co. opens Aden Harbor's third fueling terminal in July. The $1,100,000 facility was built on 6 acres of reclaimed land next to the breakwater on the north side of the harbor. First Persian Gulf stock will be delivered to the new installation in mid-June.

Aden's other two terminals are operated by Caltex Oil, Ltd., and British Petroleum Co., Ltd. The port will supply nearly 73,000 bbl. daily to passing vessels—about 17,000 bbl. more than New York, which had been the world's leading bunkering port.

Shell-B.P. Petroleum Development Co. of Nigeria has disappointing results in its 2 Akukwa in eastern Nigeria. The well failed to encounter either oil or gas in the formation which caused a spectacular blowout from 8,000 ft. in the first test 600 yd. northeast. Small gas shows will be tested further down the hole, which was bottomed at 11,992 ft.

Petroleum Chemicals, a member of the Royal Dutch-Shell Group, will add an ethylene oxide unit at its Partington, England, plant. Lummus Co. will build the unit using Shell Development Co.'s direct oxidation process. Lummus is building similar units for Wyandotte Chemical at Geismar, La., and Calcasieu Chemical at Lake Charles. The units will be the first to use the process on a commercial scale.

Standard - Vacuum Oil Co. plans to increase the capacity of its Bombay refinery from 28,000 to 33,000 bbl. daily in a 5-year, $10,600,000 expansion program.

The company will step up kerosine production and will add facilities to make asphalt, L.P.G., solvents, and jet fuel. It also will produce a specialty product, jut batching oil. This will be used to treat jute, one of India's major farm products. The expansion will save India about $2,500,000 a year in foreign exchange.

Russia claims to have discovered a new oil field in the area northwest of Grozny in the Northern Caucasus. One of five wildcats started last year by the Malgobek Oil Trust has begun flowing at the rate of 1,860 bbl. of light oil daily, according to Russian reports.

PRODUCT BUTADIENE is separated from its raw material and intermediate products in these towers. There are 29 such towers.

First Postwar Butadiene Plant

...and also first to be privately financed—now on stream

By W. J. Brack and M. R. Beychok

THE FIRST butadiene plant built since World War II has gone on stream. The plant, owned and operby Texas Butadiene & Chemical Corp., of Houston, is also the first privately financed butadiene plant in the nation.

The $30,000,000 plant is one of the latest additions to the rapidly expanding petrochemical industry centered around the Houston-Gulf Coast area. Designated as the Lyondell plant, and located on 410 acres of land adjacent to the San Jacinto River between Houston and Baytown, Tex., the plant was designed and constructed by Fluor Corp., Ltd.

Starting with n-butane and isobutane as raw-material feeds, the plant was designed to produce 64,800 tons per year of butadiene and about 2½ million barrels of high-octane aviation-grade gasoline. Under an alternate mode of operation, the plant can produce 86,000 tons per year of butadiene for use in the synthetic-rubber, textile, paint, and chemical industries.

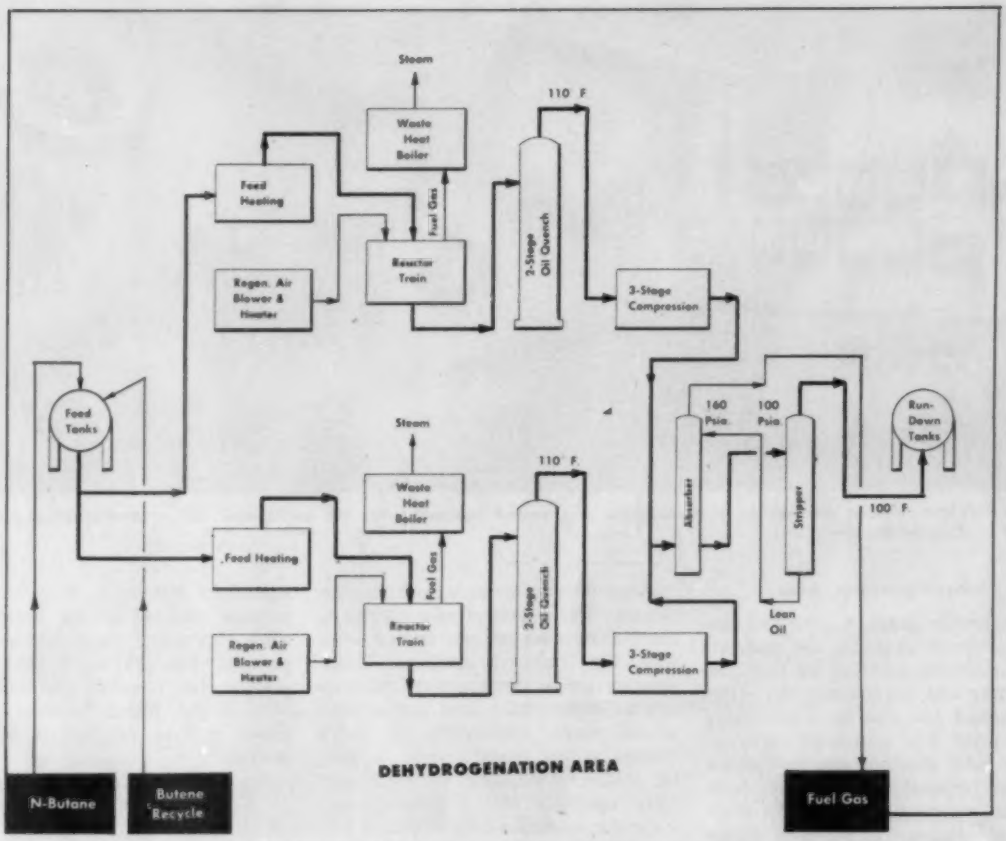
W. J. Brack is with Texas Butadiene & Chemical Corp., and M. R. Beychok is with Fluor Corp., Ltd.

Processing area . . . The processing area is basically divided into three areas:

- The dehydrogenation area, licensed by Houdry Process Corp., catalytically converts n-butane to butadiene and butylenes.
- The recovery area, licensed by Phillips Petroleum Co., separates and recovers butadiene and butylene-containing streams by employing furfural extractive distillation as well as conventional fractionation.
- The sulfuric acid alkylation area, licensed jointly by Stratford Engineering Corp. and Texaco Development Corp., charges fresh isobutane and butylene-containing streams from the recovery unit. This mixture is contacted with sulfuric acid and the resulting reaction effluent is fractionated to yield a light avgas alkylate and a motor-gasoline alkylate.

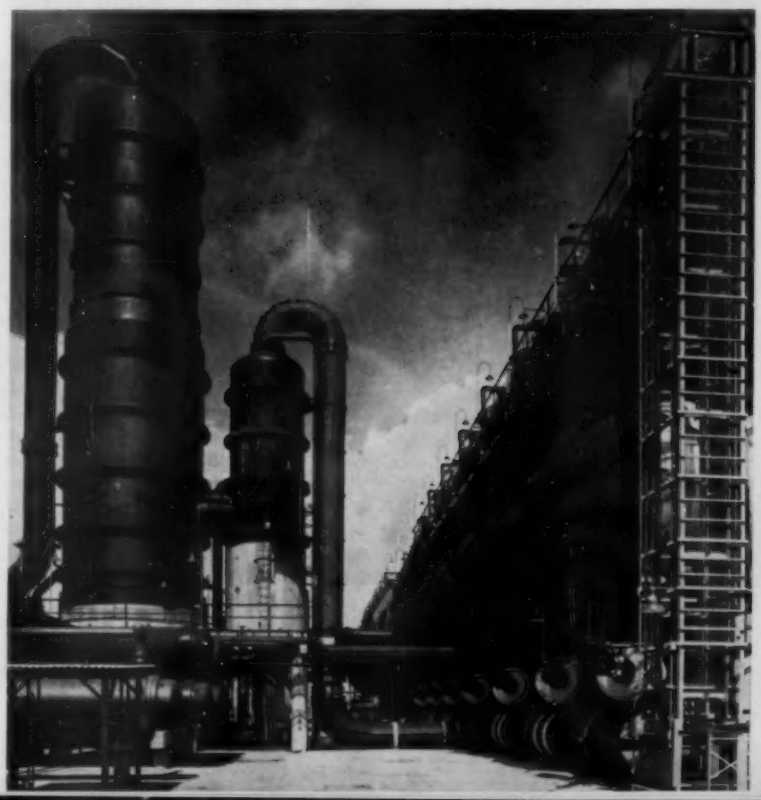
Process arrangement . . . The three processes employed by T. B. & C. have all been used individually before and all have commercial experience. However, the T. B. & C. plant is the only one to combine the three processes into one operating unit so as to

PETROCHEMICALS



THE DEHYDROGENATION OPERATIONS take place as shown in this schematic flow diagram of the dehydrogenation area. **Fig. 1.**

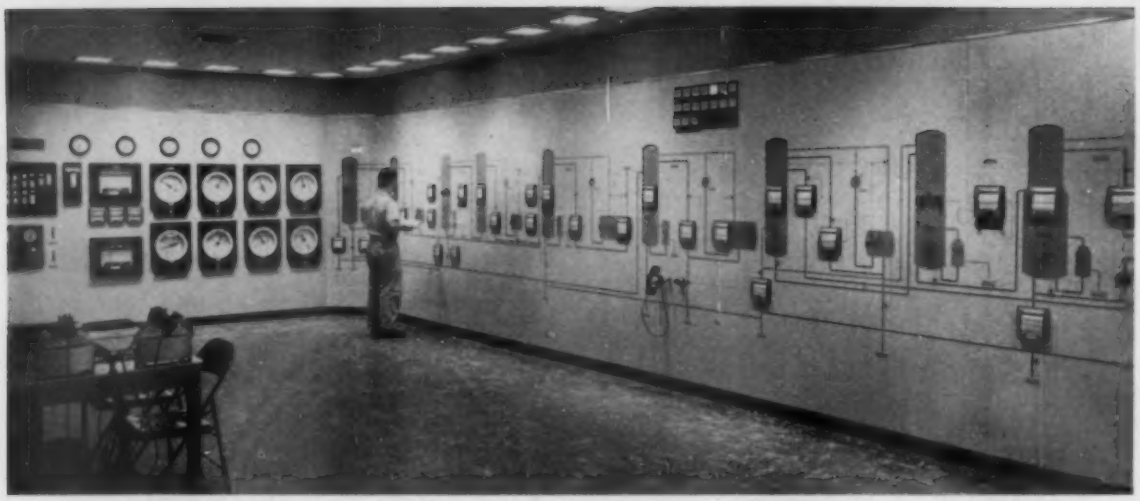
THE HOUDRY UNITS, where dehydrogenation is carried out, are at right. The hot gases which exit from these units are cooled in the oil quenching towers at left.



produce two such diverse products as butadiene and aviation gasoline.

The ability of the Houdry process to dehydrogenate butane in one step to butadiene and butylenes gives the plant its unique dual purpose capabilities. By employing the Phillips extractive distillation to separate the product butadiene from the butylenes, an excellent butylene feed stock is obtained for the alkylation unit.

Plant operation differs from other commercial installations of these processes on two major points. The only other commercial Houdry dehydrogenation unit in operation is currently being used primarily to produce butylenes; whereas the T. B. & C. installation is operated specifically to produce both finished butadiene and butylenes for alkylate feed stock. The other operating furfural extractive distillation units are in use to separate butane from butylenes and to separate butylenes from butadiene; whereas this unit is designed and operated to separate butadiene from a mixture of butane, butylenes, and butadiene.



THIS CONTROL ROOM contains the instrumentation and control equipment for the purification and product-isolation operations. It's one of three in the new plant.

Dehydrogenation Area

The dehydrogenation area includes the equipment required for preheating and dehydrogenating the feed, for quenching and compressing the effluent reaction gas, and for regenerating the catalyst. The associated vapor-recovery unit contains the equipment for the removal of byproduct light ends by means of an absorber-stripper cycle. Because of the large equipment sizes involved, and to provide operational flexibility, a good portion of this area is split into two identical parallel process trains (see Fig. 1).

The fresh butane feed and the recycle streams are pumped to the units from storage, combined, and then vaporized by exchange with hot quench oil. The vaporized feed then passes through fired heaters where it is super-heated to the required reaction temperature.

The heated feed vapors flow through the reactors at 3.5 psia. where the dehydrogenation reaction occurs. The reaction effluent gas is immediately quenched with oil in two stages of direct-contact towers. The hot quench oil is then used to vaporize the unit feed before being cooled and returned to the quench towers. The quenched effluent gas flows to the product compressors.

Reactors . . . Each reactor train contains seven reactors which are horizontal, refractory-lined vessels containing a bed of Houdry chrome oxide-alumina catalyst. Coke is deposited on the catalyst during the reaction period and is subsequently removed by combustion with air during a regeneration period. Prior to the introduction of air, the reactors are purged and evacuated.

After the regeneration with air, the reactors are evacuated and purged to remove residual oxygen before reintroducing feed hydrocarbons. Three reactors are on stream, three reactors are on regeneration, and one reactor is on purge, evacuation, or valve change at any given instant. A master cycle timer, actuating hydraulically operated valves, controls the cycle for each reactor train.

The regeneration air is compressed by turbine-driven axial compressors and preheated to the desired temperature by direct combustion with fuel gas. The hot effluent flue gases from the reactors flow through waste-heat boilers for steam generation prior to exhausting to the atmosphere.

For safety reasons, the hydraulically operated reactor valves are sealed with inert gas which is automatically cut in when the valves are in their closed position.

Effluent gases . . . The reaction effluent gases contain butadiene, butylenes, unreacted butane, hydrogen, light hydrocarbons, small amounts of inert gas from the valve blanketing, and steam from reactor purging. Three stages of compression are used to compress the gases to 145 psig.

Interstage cooling is provided and direct water injection into the first and second-stage compressors is used to limit the gas temperature as a precaution against butadiene polymerization. Facilities are employed for the continuous injection of blade-washing oil to the second and third compression stages.

The compressed vapors are then processed in a conventional absorber-stripper cycle employing a naphtha as absorption oil. The absorber is designed to recover a portion of the propane and all of the butane, butenes, butadiene, and heavier components. The rich oil is sent to the stripper for removal and condensation of the mixed product stream, which is then pumped to rundown storage.

To prevent an undesirable buildup of impurities in the absorption oil, a continuous slip stream is fed to a small fractionating column for purification.

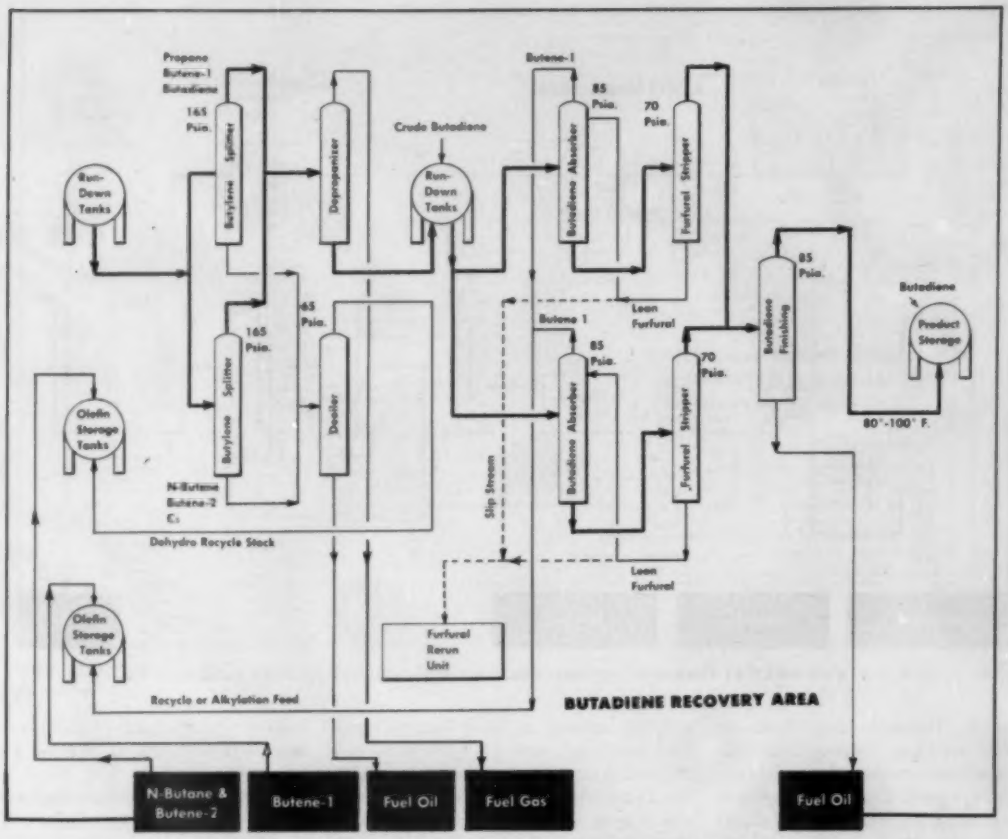
Butadiene Recovery Area

The butadiene-recovery area contains the equipment for separating the product butadiene from the mixture of butane, butenes, and residual light ends received from the dehydrogenation area. (See Fig. 2). The separation is accomplished by first fractionating the mixture to split the butadiene and lighter components from the butane and heavier components.

The butylene-splitter overhead is then depropanized and the crude butadiene and butene-1 are pumped to rundown tanks.

The butylene-splitter bottoms are deoiled in a fractionating column designed to remove any heavy ends, principally butadiene dimers. The butane and butene-2 are then pumped to storage for use as recycle to the dehydrogenation area.

The depropanized stream of crude butadiene and butene-1 is returned from storage and separated by extractive distillations using furfural as a selective solvent for butadiene. The butadiene absorber overhead stream of butene-1 is sent to storage for use as either recycle to the dehydrogenation area or as feed to the alkylation area.



BUTADIENE RECOVERY is carried out as shown in this schematic flow diagram. **Fig. 2.**

Stripping . . . The butadiene is recovered by stripping from the furfural and then removing any residual impurities, principally small amounts of heavy acetylenes and butene-2, in a final finishing fractionation column.

Again, due to the equipment sizes required, portions of the butadiene-recovery area are split into parallel trains. This not only provides operating flexibility but, combined with the parallel dehydrogenation reactor trains, allows scheduling of staggered shutdowns for catalyst changeovers.

Since the solvent furfural tends to build up an undesirable level of butadiene and furfural polymers, a small rerun unit is provided for purification of a slip stream of furfural either continuously or on a batch basis.

Provisions are also made for continuous injection of an aqueous nitrite solution into the major fractionation columns as a precaution against a buildup of peroxides and the resultant accelerated formation of butadiene polymers, to avoid reboiler fouling problems.

Alkylation Area

The alkylation area contains all of the equipment necessary to react the butane-butene streams from the recovery area with fresh isobutane feed and to separate the reaction products into an internal isobutane recycle stream, normal butane for recycle to the dehydrogenation area, a light alkylate product, and a motor alkylate product.

The area is a conventional sulfuric acid alkylation plant employing the effluent refrigeration principle as licensed by Stratford Engineering. It includes four parallel contactors so designed as to allow operation of all or part of the contactors. One design innovation at T. B. & C. was the combining of the usual compressor suction dry drum with the refrigerant flash drum into a single vessel. This results in a significant capital cost savings as well as in simplifying the unit operation. Another innovation employs the liquid refrigerant stream to cool the flow of compressor antisurge gas by direct contact and heat transfer, resulting in a system which can be "blocked in" and put on recycle for indefinite periods.

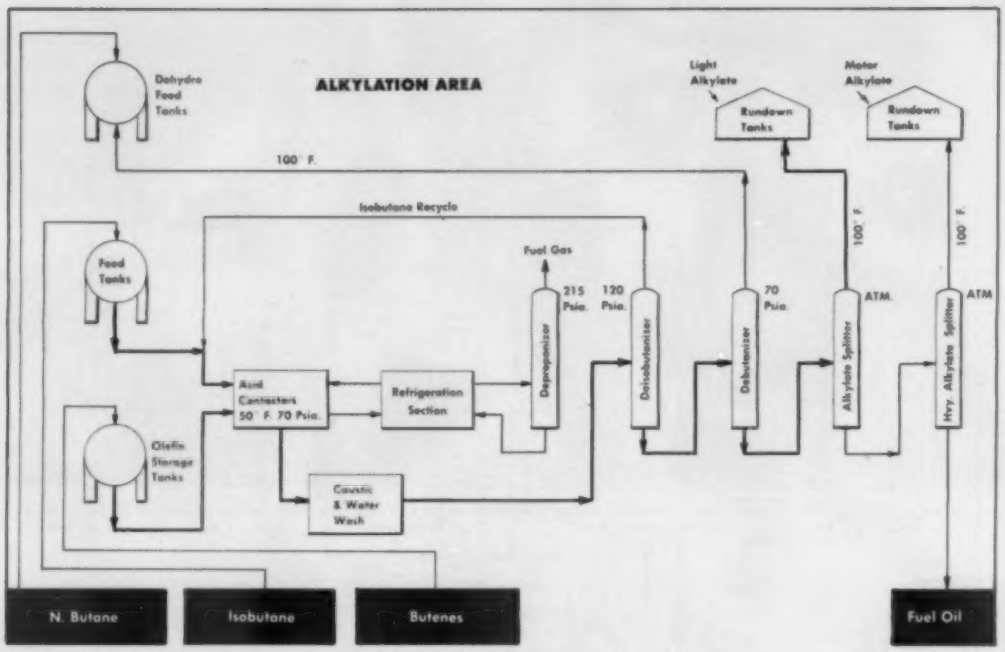
A conventional fractionation train of four columns (see Fig. 3) splits the reaction effluent into an internal isobutane recycle, n-butane for recycle back to the dehydrogenation area, and into the two product alkylate streams. The 335° F.-end-point light alkylate is blended with isopentane (or other suitable blend stock) leaded with TEL, and marketed as 115/145 aviation gasoline. The 400° F.-end-point heavy alkylate is marketed as a motor-gasoline blending component.

Offsite facilities . . . The Lyondell plant is an integrated and self-sufficient plant complete with all the required on and offsite facilities.

The plant site storage includes 139,000 bbl. of L.P.G. storage spheres for butane, isobutane, butene, crude butadiene, and product butadiene. The avgas rundown, blending, and product storage includes 10,000 bbl. of spheroid tankage; 60,000 bbl. of floating-roof tankage; and 20,000 bbl. of cone-roof tankage.

The offsite storage is located at Mont Belvieu, Tex., where the T. B. & C. engineering staff designed and had constructed some 1,500,000 bbl. of underground salt-dome storage for L.P.G.

Pipelines to and from the plant site total 63 miles and include lines to Mont Belvieu and the Hess Ter-



ALKYLATION OPERATIONS use butylenes which are separated from product butadiene. Fig. 3.

minal on the Houston Ship Channel.

Railroad tank-car loading and unloading facilities at the plant site include 12 car spots. Truck loading and unloading facilities include four truck spots.

Plant utilities . . . The plant steam requirements are furnished by four 600-psig. steam-generating units rated for a total of approximately 1,000,000 lb. per hour of steam. About 240,000 lb. per hour of 250-psig. steam is derived from the dehydrogenation-unit waste-heat boilers.

Cooling water is supplied by an 11-cell induced draft cooling tower rated for 116,000 g.p.m. of circulation at an over-all Δ T of 23° F.

About 25 per cent of the plant fuel-gas requirements are supplied by offgas streams from the processing units. The remainder is purchased from outside sources.

Other utilities include instrument air, fire and potable water, water-treating facilities, normal and emergency electrical power, and inert-gas-generation units.

Cycle Timer

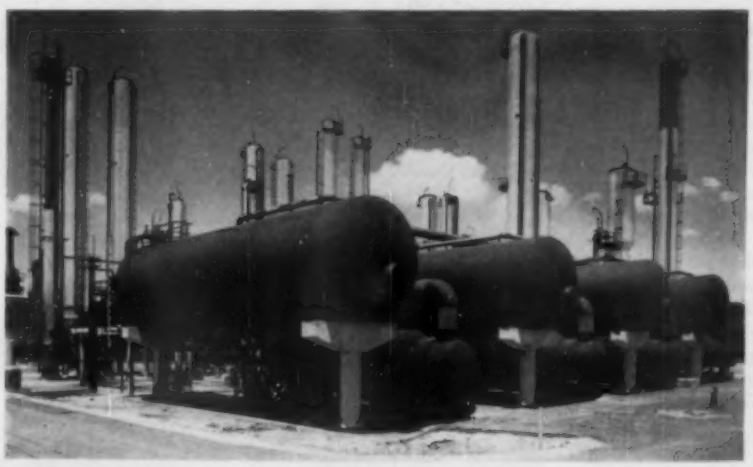
The master cycle timer for each recorder train is basically the "brain" of the dehydrogenation unit. The timer controls the cyclic process and safeguards the unit against maloperation. Not only does the timer send the electrical impulses to initiate opening and closing of reactor valves, but it also checks in subsequent steps on whether or not the valves have actually moved to their correct and safe position.

During certain phases of the cycle, the timer also checks the pressure in the reactor to determine if it is safe to proceed to the next phase. Should a timer check fail to be satisfied, the timer automatically stops and sounds an alarm. At the same time an electrical brake is applied to keep the timer from "coasting" to the next point.

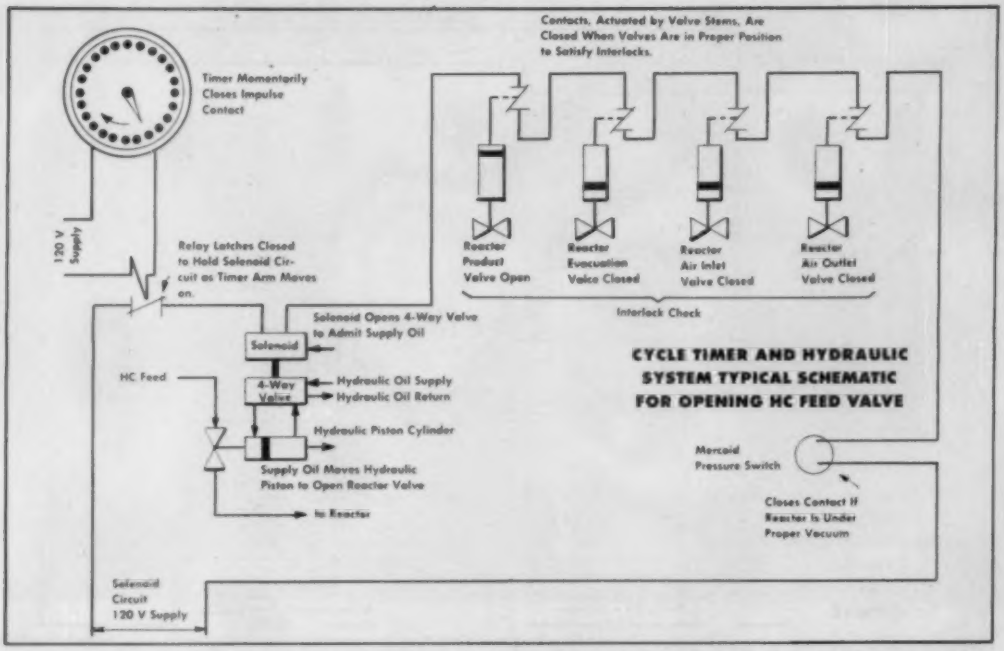
The timer goes through 900 points in a 21-minute cycle (however, all of the points are not actually used). During this 21-minute cycle, each of the seven reactors is on stream 9 minutes, on regeneration 9 minutes, on various purge and evacuation steps for 1½ minutes, and switching valves for 1½ minutes.

Through an electrical circuit which is completely independent of the cycle-timer test circuits, a system of electrical interlocks prevents the opening of any individual valve unless the other valves on that reactor are in a safe position for that phase of operation. See Fig. 4 for a typical schematic of the components involved in the opening of a single valve.

Numerous other devices have been built into this system to insure the complete safety of this operation. These safety devices, alarms, and lights, indicating the open or closed



ALKYLATION CONTACTORS take butylene streams from towers in background and react them with isobutane.


Contacts, Actuated by Valve Stems, Are Closed When Valves Are in Proper Position to Satisfy Interlocks.
Timer Momentarily Closes Impulse Contact
120 V Supply
Relay Latches Closed to Hold Solenoid Circuit as Timer Arm Moves on.
Reactor Product Valve Open
Reactor Evacuation Valve Closed
Reactor Air Inlet Valve Closed
Reactor Air Outlet Valve Closed
Interlock Check
Solenoid Opens 4-Way Valve to Admit Supply Oil
Solenoid
HC Feed
4-Way Valve
Hydraulic Oil Supply
Hydraulic Oil Return
Hydraulic Piston Cylinder
Supply Oil Moves Hydraulic Piston to Open Reactor Valve
to Reactor
CYCLE TIMER AND HYDRAULIC SYSTEM TYPICAL SCHEMATIC FOR OPENING HC FEED VALVE
Mercoid Pressure Switch
Closes Contact If Reactor Is Under Proper Vacuum
Solenoid Circuit 120 V Supply

THE MASTER CYCLE TIMER controls the cyclic dehydrogenation process and safeguards the unit against maloperation. Fig. 4.

position of each of the 50 valves per reactor train, are all located in the dehydrogenation-unit control room.

Hydraulic system . . . The dehydrogenation unit employs a hydraulic power system for opening and closing of the reactor valves upon receiving an electrical signal from the cycle timer. This is the first commercial application of a central hydraulic system in a petrochemical process of this scope and is very probably one of the largest commercial applications of hydraulic power for an operational control system.

The hydraulic power is applied to each valve as a product of flow times pressure. The system pressure is maintained by sliding-vane rotary pumps. The dehydrogenation cycle inherently causes intermittent high and low demands for hydraulic power since, at times, it is required to move a 30-in. valve and, at other times, it is required to move a 3-in. valve.

Also, due to the fact that some of the valve motions require 21 seconds to complete, there is more than one valve moving at a time. For this reason, each reactor hydraulic control panel is provided with a hydraulic oil accumulator which accumulates and "stores" hydraulic oil during low demand periods and then releases the oil during high demand periods. See Fig. 5 for a typical schematic of the hydraulic-system components.

In order to control the rate of opening or closing of each valve so as to meet the time allotted for that valve motion on the cycle timer, each valve control unit contains a hydraulic oil-flow controller. The flow controller is so located as to control the oil flow during both the opening and closing stroke.

Also, in order to prevent "slamming" a valve shut with enough force to wedge the valve too tightly closed, a pressure reducer controls the oil flow for the closing stroke at a much lower pressure than the opening-stroke oil flow.

A four-way solenoid valve directs the oil flow in the proper direction for the desired opening or closing stroke. (See Fig. 5). The four-way valve has both an "open" solenoid and a "close" solenoid which receive their signal from the cycle timer as depicted in Fig. 4.

In the event of a failure of the solenoid valve to function properly, a manual four-way bypass is provided.

Not shown in Fig. 5, but included within the hydraulic piston cylinder, is a "hydraulic cushion" which causes the reactor valve to travel at a very slow rate during the last fraction of the opening and closing strokes as an additional precaution against slamming a valve.

Compressors . . . The process equipment includes five relatively large compression systems and has probably some of the largest axial flow compressor installations in a petrochemical process unit to date. The two regeneration air blowers are 9,700-b.hp. axial air compressors operating at 3,600 r.p.m. These machines contain five stages of blading and are driven by condensing steam turbines.

The two first-stage reactor effluent gas compressors are 3,800-b.hp. axial compressors operating at 3,600 r.p.m. These machines contain 11 stages of blading and are also driven by condensing steam turbines.

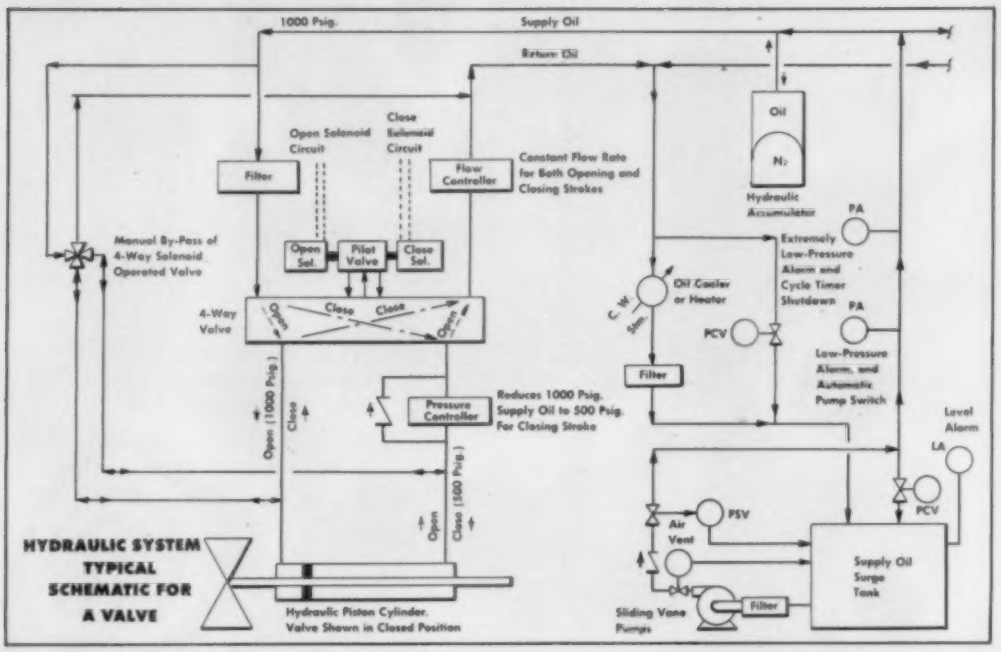
The two second-stage and the two third-stage gas compressors are conventional centrifugal units also driven by condensing steam turbines.

The alkylation-area refrigeration compressor is a 4,275-b.hp. centrifugal compressor driven by a back-pressure steam turbine. The 70-psig. exhaust steam derived from this unit is sufficient to supply all of the 70-psig. reboil heat requirements of the alkylation area.

On-stream analyzers . . . The plant was designed for maximum utilization of on-stream hydrocarbon analyzers. Even within the short period of experience thus far gained with these instruments they have proved themselves to be invaluable. A list of the nine analyzers and their functions is given in Table 1.

Plant Startup

T. B. & C. assumed the basic responsibility for the initial startup. The contractor and the three licensors fur-



A HYDRAULIC POWER SYSTEM is used for opening and closing the dehydrogenation reactor valves, upon receiving an electrical signal from the cycle timer. Fig. 5.

nished technical and operating advisors during the first few weeks of initial operation.

The entire plant startup was characterized by relatively smooth operation and very few process problems were encountered. The high caliber of operating personnel and an excellent prestartup training program contributed greatly to the smooth startup.

The prestartup training program was divided into classroom study, written examinations, field study in the unit areas, and verbal field examinations. As an incentive to promote interest in the training program, the classification of each operator was decided upon completion of the training program and was determined by his performance during the training program.

The program was organized and supervised by T. B. & C. operating supervisors and engineers. The contractor's personnel, licensors' advisors, and equipment vendors' representatives also aided.

"The entire plant startup was characterized by relatively smooth operation and very few process problems were encountered. The high caliber of operating personnel and an excellent prestartup training program contributed greatly to the smooth startup."

Piecemeal startup . . . To facilitate initial operation and to get on stream more rapidly, the processing areas were turned over to T. B. & C. by "pieces" as they were completed. The initial unit turned over was a portion of the utility area on December 12, 1956. By mid-December, part of the steam generating facilities were on stream.

The first Houdry unit was turned over on January 5, 1957. Within 46 days, on February 21, the unit was on stream. During this period, the reactor brickwork and all of the fired heaters were dried out and catalyst was loaded. Upon completion of the dryout and catalyst loading, the reactors were heated up with hot regeneration air.

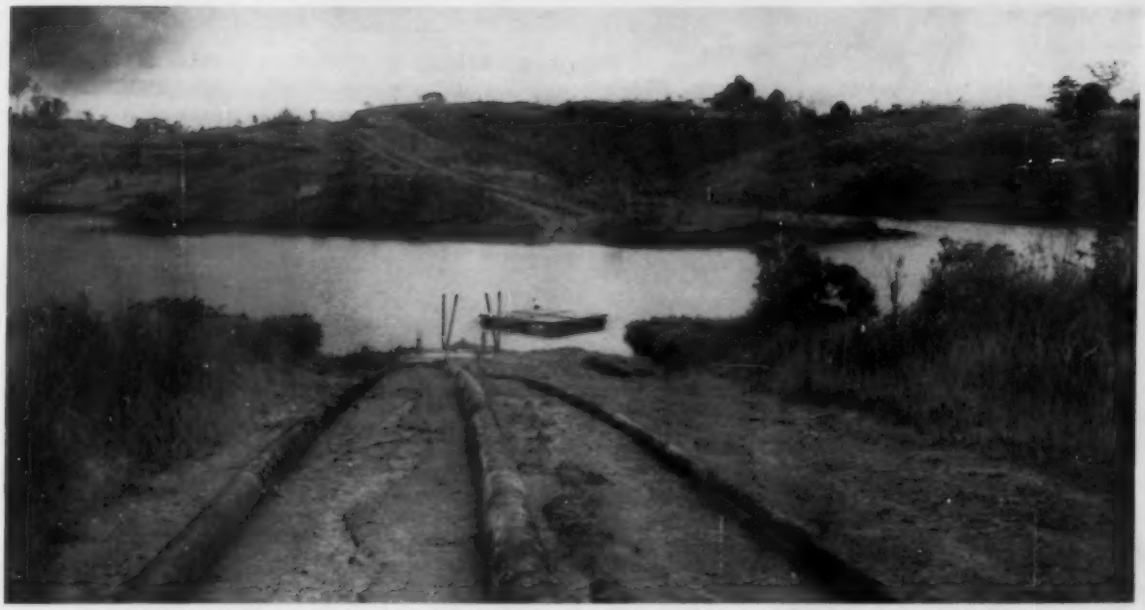
The remainder of the unit was air-freed with inert gas and the product compressors were started on a recycle operation. As soon as a vacuum test was completed, the inert gas was displaced with a butane-fuel gas mixture. At this point, the automatic cycling of reactor valves was initiated and, shortly afterwards, butane was charged to one reactor on a once-through basis. As soon as all seven reactors were commissioned, the unit was on stream.

The recovery area was turned over on February 1. Since it was desirable that the recovery unit be on stream prior to the Houdry unit, an outside feed stock was purchased for the startup. By February 21, the recovery area was on stream and completely ready to receive the Houdry-unit effluent as the first Houdry unit went on stream.

The alkylation area was turned over on February 1 and, by February 21, it was partially on stream, charging one contactor section. On February 26, all four contactors were on stream.

TABLE 1—ON-STREAM HYDROCARBON ANALYZERS

Location	Function	Monitored Component	Type
Ultraviolet	Butadiene	Controller	11th tray north butylene splitter
Ultraviolet	Butadiene	Controller	11th tray south butylene splitter
Ultraviolet	Butadiene	Recorder	Deoiler overhead and depropanizer overhead
Ultraviolet	Butadiene	Recorder	North and south butadiene absorber overhead
Ultraviolet	Butadiene	Controller	5th tray butadiene finishing column
Infrared	Butene-1	Controller	25th tray north butadiene absorber
Infrared	Butene-1	Controller	25th tray south butadiene absorber
Infrared	Acetylenes	Controller	79th tray butadiene finishing column
Chromatog	Butane	Recorder	89th tray south butylene splitter



Three-inch "defroster" line to be laid under Sumatra 8-in. crude line in project involving . . .

Pipelining Crude With 110° F. Pour Point

By J. M. Rupert and B. N. van Diemen de Jel

PART 1 OF TWO PARTS

UNDER construction by Standard-Vacuum Petroleum Mij. is a 150-km. (94-mile) 8-in. crude pipeline and roadway from Lirik field in Central Sumatra to a deep-water terminal on the Siak River, near Buatan. The crude will be loaded on tankers and transported approximately 800 km. to the S.V.P.M. refinery on the Musi River at Sungei Gerong, near Palembang in South Sumatra.

The pipeline right-of-way traverses hilly jungle country with the exception of approximately 20 km. of swamps near small streams and rivers. In some localities the vegetation is extremely heavy and the clearing of the right-of-way required considerable effort. Some of the hills were high and their slopes steep, requiring large cuts (30 to 40 ft.) and fills.

Five pump stations and a loading terminal, to be completed by the end of 1957, will handle an exceptional crude which has a pour point of from 105° to 110° F.

The pipeline design was based on actual pumping tests. In order to describe the work involved in developing the efforts made on Lirik crude-

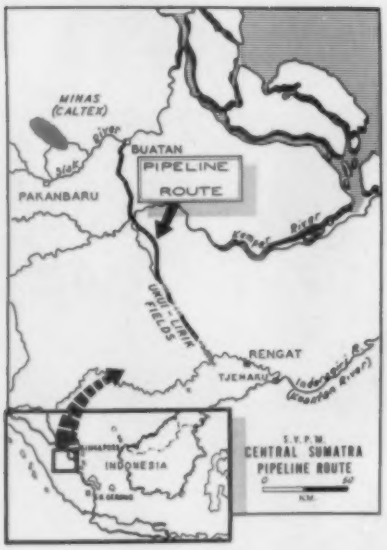
Conclusions from test pumping . . .

TEST-PUMPING RESULTS of Lirik crude (34° A.P.I., 105° to 110° F. pour point, 84° F. Pensky Martens flash, and 1 psi. vapor pressure at 100° F.) point to these results, based on maximum pump discharge pressure of 1,000 psi. and maximum initial curve temperature of 155° F.:

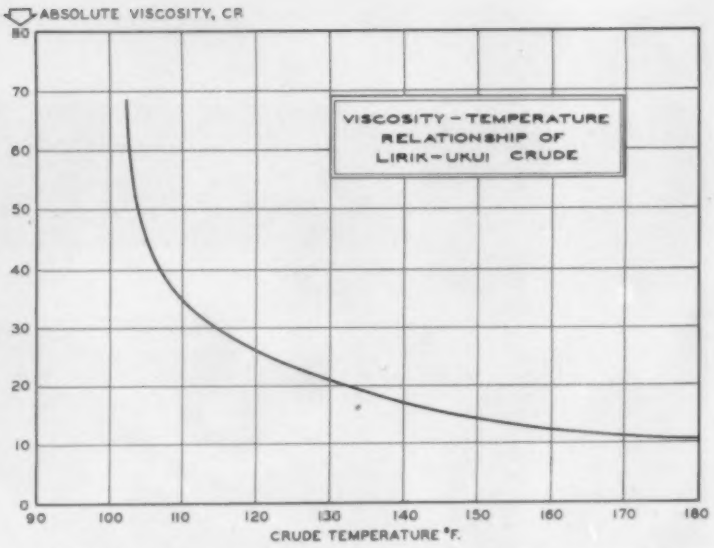
FOR A SURFACE LINE, the Lirik system would have to be designed for maximum capacity 20 per cent higher than average field production to allow for average weather conditions and operational difficulties. To handle an average rate of 20,000 bbl. daily with a 6-in. line would require station spacing not exceeding 15 km. The use of a surface hot-water defroster line along the 6-in. pipe would favor a dependable operation. Station spacing could be increased to some 20 km. on an 8-in. line. Lirik crude would have to be pumped at about 32,000 bbl. daily through such a system to maintain a sufficiently high velocity to compensate for average weather conditions. The use of a defroster line would also be advantageous.

FOR A BURIED LINE, station spacing for a 6-in. line could be about 22 km. at 20,000 bbl. daily. For 8-in. it could be 30 km. at 32,000 bbl. daily. Station spacing on a buried line is more favorable than for a surface line and operation of a buried line is affected less by weather.

A surface line, preferably with a defroster line, would operate more successfully than a buried line over long stretches of swampy terrain. In all cases it would be necessary to maintain the highest velocity possible within practical limits while operating either the line for heated crude or the defroster line. Generally speaking it would be preferable to design a system with the smallest feasible pipe diameter.



ROUTE traverses hilly jungles, swamps from Lirik field, Central Sumatra, to Buatan terminal on river. Fig. 1.



VISCOSITY of Lirik crude is shown at various temperatures. On cool nights it will support the weight of a man. Fig. 2.

handling methods, a brief history of Lirik field follows:

Climate, terrain . . . The Lirik fields of Central Sumatra, which were discovered by S.V.P.M. in the late thirties, are located in the Kuantan River basin, approximately 230 km. inland from the delta on the east coast. Fig. 1 is a map of Sumatra which shows the location of these fields. The Lirik producing area itself, situated on low rolling hills, has convenient topography for oil-field operations. The climate is humid and the precipitation is high, particularly during the first and last quarters of the year. The average yearly rainfall is 115 in. with a maximum intensity of ½ in. per hour. The atmospheric temperature ranges from approximately 70° F. in the early morning to about 95° F. in the daytime. The terrain east of Lirik along the Kuantan River is low and much of it is peat swamps which in many cases have a considerable depth.

Most of the country along the river east of Lirik is inundated several times during the annual rainy season, and was not a suitable pipeline route to a deep-sea loading terminal. By routing the pipeline north, however, from the producing field to the Siak, a distance of 150 km., the pipeline could be constructed for the greater part on dry terrain.

Crude characteristics . . . The reservoir temperature in Lirik field is relatively high. It is 173° at 1,700 ft. subsurface. This corresponds to an extraordinary temperature gradient of less than 20 ft. per degree, as compared to the normal gradient of 60 ft. per degree.

Stock-tank crude has a gravity of 34° A.P.I. and a pour point of 105° to 110° F. Its viscosity at various temperatures is shown in Fig. 2. Due to these conditions, a pool of crude, although a liquid in the direct rays of the sun, will freeze sufficiently during the coolest part of the night to support the weight of an average man.

Crude-Transportation Problem

The transportation of the field output to a deep-water terminal, where it could be loaded on tankers and shipped to the S.V.P.M. refinery at Sungei Gerong, presented an extremely serious problem due to the high pour point of the crude. Many suggestions were made for a solution to the problem. The most typical examples of these are the following:

By barge . . . Crude would be transported by barge from Lirik to a deep-water terminal along the Kuantan River. The river conditions for the first 40 km. downstream from Lirik are such that navigation presents great difficulties. This scheme is in operation at the present time at a daily rate of 1,500 bbl. The barging operation will be suspended, however, as soon as the Lirik-Buatan pipeline is in operation.

By pipeline . . . Several pipeline possibilities were considered:

- **Blending the crude** with naphtha or some equivalent product. It was found from actual pumping tests in the field that a mixture of 35 per cent naphtha to 65 per cent crude was pumpable in a buried line. The disadvantages of this scheme are the necessity for a larger-diameter crude line, a topping plant at the terminal, and a return system for the naphtha to the field.
- **Emulsification with water.** This possibility was discarded inasmuch as Lirik crude tends to form stable emulsions with water which have high viscosities.
- **Moving the crude** through a buried line as a solid plug by means of a surrounding water medium. This

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Van Diemen de Jel

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B. N. van Diemen de Jel holds an M.S. degree in mechanical and aeronautical engineering from Delft Technical University, The Netherlands. He joined Stanvac in Indonesia in 1939. Now production coordinator, he has been senior pipeline engineer, reservoir engineer, and acting chief petroleum engineer.

scheme was tried on a laboratory scale, using glass tubing, with some apparent success. It was felt, however, that this method would not be feasible in practice.

- **Consideration was given** to the installation of visbreaking equipment in the field, but in view of the large investment involved this method was discarded.
- **Electrical heating** of the pipe wall or of the crude in the pipeline was considered but rejected in view of the high cost involved.
- **Heating the crude** at various stations along the line. This suggestion appeared to offer the best possibilities of a solution to the problem. It was, therefore, finally decided to institute a study on the feasibility of handling heated crude by conducting actual pumping tests.

Description of Tests

Prewar . . . An experimental 6-in. pipeline, 2 km. long, was constructed in Lirik during 1941. Facilities were provided for pumping at rates up to 9,500 bbl. daily and heating the crude to temperatures up to 200° F. The line was not buried during the first part of the tests, but was later. Pumping was done at various temperatures and at rates of 4,000 and 9,500 bbl. daily. Many data were accumulated on pressure behavior and heat loss. Unfortunately the experimental pumping had to be discontinued due to the Japanese invasion.

During Japanese occupation . . . After the Japanese occupied Sumatra in February 1942, they proceeded with development work in the Lirik area. Additional wells were drilled and a 6-in. surface pipeline, 55½ km. in length, was laid between Lirik and Sungei Tjenaku, a point on the Kuantan River where barges could be loaded. A 2-in. steam line was laid parallel to the 6-in. crude line, the two were wired together and a covering of coconut husks applied for insulation.

Heater stations were installed at 4-km. intervals to supply steam to the 2-in. line. One pump station was installed at Lirik with pumping equipment for loading at Sungei Tjenaku. Information on the operation of the pipeline by the Japanese is sketchy and unreliable; however, it has been estimated they pumped only 200,000 bbl.

Postwar . . . When S.V.P.M. personnel reentered Lirik in January 1949, it was decided to continue the test pumping. A description of the experimental pipeline system which was constructed and an outline of the test program follow:

. . . Pump station. Four ¾ by 10-in. Gaso pumps with Caterpillar D-13000 diesels as prime movers were installed at the test station. Heat was provided by two 50-hp. and three 25-hp. Jonker fire-tube boilers and applied to the crude by steam coils in the storage tanks and through a heat exchanger inserted in the discharge line. The maximum throughput capacity of the pump station was approximately 23,000 bbl. daily with a maximum initial crude temperature of 200° F.

. . . Pipeline. The pipeline consisted of 11 km. of 6-in. welded pipe which was laid from Lirik to a point 5½ km. distant and back to the storage tanks at Lirik. Pressure gages and thermometers were placed in the line at regular intervals. Throughout most of the tests the line was not buried. Later, however, a 3-km. section of the line was buried along with a 2-in. hot-water or "defroster" line. Both lines were buried in the same ditch to a depth of from 6 to 12 in.

In order to determine the effect of solar radiation on the 6-in. line, an instrument was devised for this purpose. It consisted of a 2-in. pipe, about 3 ft. long, filled with water and placed parallel to the general direction of the test line. It was found that the temperature of the instrument at any time approximated the pipe-wall temperature of the test line when the crude in the pipe was in the process of liquefying or freezing and no movement was taking place. Hourly readings were recorded as the "idle-line temperature." It will be readily understood that the idle-line temperature equals the atmospheric temperature plus an increment accounting for solar radiation on the pipe. The maximum value of this increment was found to be 35° F. The idle-line temperature is the actual index which determines the effect of atmospheric conditions on pumping.

. . . Test phases. Starting up after complete solidification of crude in the line was studied. This was followed by continuous pumping at various rates and crude temperatures. All testing was done under widely varying weather conditions.

Test Results

(A) Starting up with congealed crude in the line.

Tests indicated that a startup could be effected through 11 km. of surface line if the idle-line temperature were 102° F. or more. This temperature was usually reached at about 10:30 a.m. on average clear days, and the normal pumping rate could be achieved approximately 1 hour later. During the entire testing program which was carried out under all weather conditions for several months, there was only one time that pumping could not be resumed after a shutdown and that was during a heavily clouded day. Heavy rains in the daytime, if followed by a comparatively clear sky, did not prevent a successful startup.

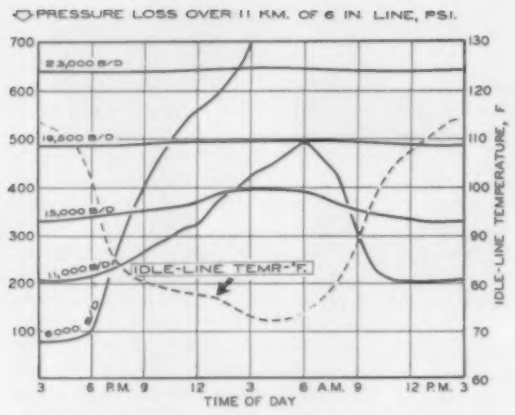
The various phases of the starting-up process may be visualized as follows: After a shutdown and complete solidification of the crude, solar radiation heats the pipe, softens the film of oil immediately adjacent to the pipe wall, and allows the solid crude to move. As the solid crude gains momentum the heat from the pipe wall is more rapidly transmitted to the solid crude, reducing the diameter of the plug. At the same time, the plug tends to break down and to become a thin paste due to the stresses exerted upon it. After all the crude has become a paste, it flows as a very viscous fluid. If the idle-line temperature remains at 102° F., the pumping rate will be sufficiently high to allow displacement of the semiliquid in the 11 km. of line with warm crude before sunset. Obviously, if the idle-line temperature rises above 102° F., the whole starting-up process is accelerated.

In the case of the above-mentioned 3 km. of buried line it was impossible to start movement of crude, irrespective of the weather conditions, without heating. However, a startup could be effected at any time by pumping water, heated to 180° F., through the 2-in. defroster line for slightly more than 1 hour.

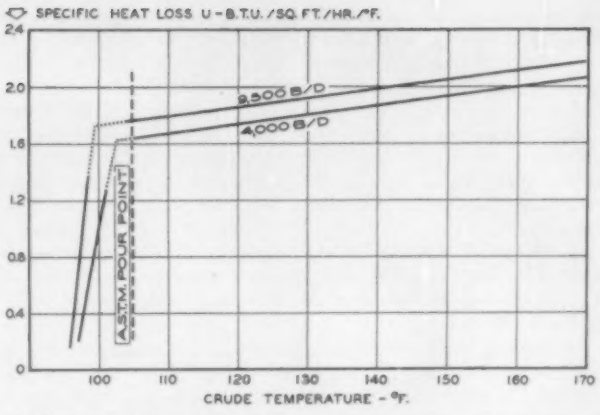
(B) Continuous pumping operations.

1. **Surface line.** This phase of the testing was concerned with how pumping could be continued under all prevailing dry-weather conditions. The results of these efforts are illustrated in Fig. 3, which depicts the pump discharge pressure for various throughput rates during the entire day. It will be noticed that during several hours of a clear day the idle-line temperature is well above the pour point of the crude. This implies that during these hours very little heating of the crude is required.

Fig. 3 also shows that for a pumping rate of 23,000 bbl. daily the discharge pressure remains almost constant irrespective of the idle-line temperature. It has been observed that at high rates, even during the worst weather conditions, the crude temperature at the end of the 11 km. of line is sufficiently high to prevent a substantial increase in initial pumping pressure. If during heavy rains the


PRESSURE LOSS OVER 11 KM. OF 6 IN. LINE, PSI.
23,000 B/D
19,500 B/D
15,000 B/D
11,000 B/D
6,000 B/D
IDLE-LINE TEMP-°F.
IDLE-LINE TEMPERATURE, F
TIME OF DAY
3 6 P.M. 9 12 3 6 A.M. 9 12 P.M. 3

PUMP DISCHARGE pressure is shown for various throughput rates during the day. Fig. 3.



HEAT-TRANSFER coefficient between crude in pipe and air around pipe is shown at various crude temperatures and throughput rates. Fig. 4.

crude temperature at the end of the line drops slightly below pour point, congealing of the crude is prevented due to turbulence.

It was found that pumping at low rates through the 11 km. of line could not be continued throughout the entire night, which is illustrated by the curve for 6,000 bbl. daily in Fig. 3. This is caused by the low flow velocity. The crude is subject to cooling for such a long time before moving through the entire line that it reaches temperature near and below pour point. At crude temperatures near pour point, the viscosity begins to increase rapidly. In addition, the rise in viscosity effects a change from turbulent to laminar flow which, in its turn, increases the apparent viscosity abruptly and accelerates the formation of congealed crude on the pipe wall. The reduction of the flow passage causes an additional increase in pressure drop. The highest pressure losses, of course, occur over the last part of the line.

As the maximum allowable pumping pressure is reached, the throughput rate will have to be correspondingly reduced. Additional cooling is the result, which is again followed by higher pressure losses. The process is thus repeated until a shutdown follows as a result of a plugged line. It should be pointed out at this time that the 11 km. of test line rested on the ground in many places. Therefore, the heat loss, and consequently the pressure drop, during the night, as shown in Fig. 3, were somewhat less than the losses for a well-elevated surface line.

2. **Buried line.** It was found from observation made on the 3 km. of buried line that the heat loss was equal to 70 per cent of that observed in the surface line during an average clear night. The weather conditions had no noticeable effect on the buried line. Calculations show that the heat loss would have been considerably less than 70 per cent if the line had been buried to a depth of 2½ ft.

During 1954 a pumping station and a 6-km. 6-in. buried line with a 2-in. defroster line was laid from the producing wells to the Kuantan River. This system is still operated to load Lirik crude on barges which are towed to the Sungei Gerong refinery.

Observations on this pipeline show that a period of 14 hours is required to defrost the 6-in. line if water heated to 180° F. is pumped through the 2-in. line at the rate of 1,000 bbl. daily. But the defrosting time is decreased to 5 hours when water heated to 180° F. is pumped through the 2-in. line at 2,000 bbl. daily. The 2-in. defroster line is laid under the 6-in. line and in contact with it. The 6-in. line is buried beneath the surface of the ground 2½ ft. whenever possible. The line operates at the rate of 1,000 bbl. per hour but operates for only 5 or 6 hours at a time.

The crude is usually heated to 150° F. and delivered to the barges at 120° to 130° F., depending upon the time required to complete the loadings. Information on the operation of the crude line is difficult to acquire due to the intermittent operation.

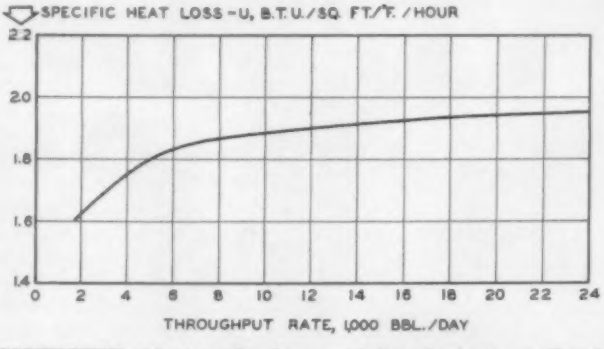
3. **Heat loss.** From the results of the surface line pumping test the relation between heat loss and flow conditions was studied.

Equation 1 permits the calculations of the over-all heat-transfer coefficient "U" from the throughput rate and the observed crude temperature along the line. (See nomenclature.)

$$e\ln \frac{\Delta T_o}{\Delta T_s} = \frac{\pi D}{c G} US \qquad (1)$$

In order to explain the behavior of "U" the following discussion is presented. If one rate of flow through a line of a given diameter is considered, the factor $\pi D/cG$ becomes a constant. When temperature readings over short pipeline intervals were taken and introduced into Equation 1, it was found that "U" is not a constant but becomes smaller with increasing crude temperatures.

The value of "U" varies for two reasons. First, as the crude temperature falls the degree of turbulence is reduced which results in a smaller heat transfer by convection from the



COEFFICIENT of heat transfer changes with throughput rates as affected by the degree of turbulence. Fig. 5.

KEY TO ALGEBRAIC EQUATIONS
(Nomenclature)

L = distance from field to terminal, in feet
s = station interval, in feet
ΔT_o = temperature difference between the air surrounding the pipe and the crude in the pipe, at the beginning of the line, in °F.
ΔT_s = temperature difference between the air surrounding the pipe and the crude in the pipe, at the end of the line, in °F.
D = outside pipe diameter, in feet
G = weight of the volume of crude passing through a cross-section of pipe per hour, in pounds
c = specific heat of the crude, in B.t.u. per pound per °F.
U = over-all heat-transfer coefficient between the crude in the pipe and the air around the pipe, in B.t.u. per hour per square foot of pipe per °F. temperature differential
H = heat loss sustained per hour in transporting G pounds of crude from the field to the terminal, in B.t.u. per hour
e = base of natural logarithm—2.7183
eln = logarithm to base e

crude to the pipe. Second, heat transfer from the pipe to the air by natural convection and by radiation is diminished as the pipe temperature decreases. Fig. 4 shows U for a 6-in. surface line, pumping Lirik crude having a 105° F. pour point, at various crude temperatures and at throughput rates of 4,000 and 9,500 bbl. daily. The flat-slope part of the curves illustrates the decrease in U with declining crude temperature. The approximate value of U in this region is 2 B.t.u./sq. ft./hr./°F. temperature difference between the atmosphere and the crude.

When the crude temperature has decreased sufficiently the flow changes from turbulent to laminar. During the pumping tests, the transition occurred at temperatures below pour point. The transition is followed by a rapid formation of a coating of congealed crude on the pipe wall. The low conductivity of the coating forms an excellent insulation against heat loss, reducing the heat transfer substantially. The phenomenon of coating is illustrated by the steep part of the U curves in Fig. 4.

Due to the increased turbulence at higher throughput rates, the heat transfer from the crude to the pipe is greater than at low rates. Fig. 5 shows the changes of U with throughput rates as affected by the degree of turbulence.

Equation 2 shows the heat loss per hour per weight unit of crude transported to the pipeline terminal.

$$H/G = c \frac{L}{s} \Delta T_o \times (1 - e^{-3.1416\,DU8/cG}) \qquad (2)$$

Obviously, it is desirable to operate with the lowest value of H/G possible, within practical limits. Equation 2 shows that H/G can be minimized by operating at a short station spacing and at the lowest feasible initial crude temperature, and by keeping the exponent of the last term in the equation low.

The initial crude temperature should not go below a minimum value, however, because of the tremendously high pressure losses which result from operating at low crude temperatures. Low values of the exponent in Equation 2 can be accomplished by operating at a high ratio between throughput rate and pipe diameter, and by minimizing the heat-transfer coefficient U. The value of U is mainly fixed by the type of line construction. For a buried line, U is always less than 70 per cent of the U for a surface line, depending on the soil conditions and the depth to which the line is buried.

Viewed from the standpoint of heat economy alone, the transportation of crude at temperatures near pour point would be ideal. However, the extremely high pressure losses which result from operating at low temperatures would necessitate using a very large-diameter line. It is felt that the use of such big-inch line would not be economically justified.

PART 2

Next week the authors discuss pipeline design and equipment for the crude and defroster lines handling high pour-point Sumatra crude.

Colorado's Gov. Steve McNichols turns the valve . . .

. . . then looks on with Union Oil's A. C. Rubel as . . .

Shale Plant Opens

PRODUCTION has been officially started at Union Oil Co.'s experimental plant near Grand Valley, Colo., for the production of shale oil. The plant was opened May 18, and by the end of the year Union hopes to have most of the answers to the economic possibilities of producing shale oil on a commercial scale.

Principles of Gas Flow

By Dr. John M. Campbell

THE FUNDAMENTAL thermodynamic equations used for liquid flow may also be used for gases. A logical starting point is the equation developed in Part 27, modified to read:

$$-\int PdV + \Delta(PV) + \Delta X + \frac{v_2^2 - v_1^2}{2g} = -W_f - W \quad (1)$$

where:

V = volume or specific volume
P = absolute pressure
X = elevation above an arbitrary plane
v = velocity
g = gravitational constant
W = work done by system
W_f = total of irreversible effects in system—usually attributed to friction

In order to conveniently handle Equation 1 several assumptions are often made:

1. That no external work is done by or on the system, i.e., W = 0.
2. That natural gas behaves as an ideal gas, i.e., $P_1V_1 = P_2V_2$.
3. That the flow is isothermal.
4. That the changes in elevation on a long pipeline are negligible, i.e., $\Delta X = 0$.

All of the above assumptions except that of ideal gases are usually satisfactory on the average pipeline. However, those equations derived on this basis usually contain a compressibility-factor correction if designed to be used at pressures over several hundred pounds per square inch (see Parts 34 and 36). The assumption of isothermal flow has little effect on the final accuracy, which may be proven by assuming adiabatic conditions, the opposite extreme.

When applying the above assumptions to Equation 1 and rearranging:

$$W_f = \int PdV - \frac{v_2^2 - v_1^2}{2g} \quad (2)$$

Differentiating:

$$dW_f = PdV - \frac{vdv}{g} \quad (3)$$

Author is chairman, School of Petroleum Engineering, University of Oklahoma, Norman.

FIELD PROCESSING

Equation 3 is as far as one may go with thermodynamics alone inasmuch as it does not provide a means of solving for the loss in energy due to friction. Experiments show that the work done in overcoming friction through distance dL is proportional to the surface in contact with the fluid, approximately proportional to the square of velocity and proportional to the density of the fluid. By including a proportionality constant "f" the equation may be written as:

$$\text{Frictional resistance} = (f)\,(dL)\,(\pi D)\,(v^2/2g)\,(\rho) \quad (4)$$

or since work equal force times distance:

$$\text{Work} = (f)\,(dL)\,(\pi D)\,(v^2/2g)\,(\rho)\,(dL) \quad (5)$$

If Equation 5 is divided by the weight of fluid in the length dL ($A \rho dL$) and the result applied to circular conduit:

$$dW_f = \frac{2f\,v^2\,dL}{gD} \quad (6)$$

and Equation 3 reduces to:

$$\frac{2f\,v^2\,dL}{gD} = PdV - \frac{vdv}{g} \quad (7)$$

By appropriate algebra, application of the ideal gas law and subsequent integration:

$$N = A\left[\frac{gM\,(P_1^2 - P_2^2)/2RT}{2fL/D + \ln P_1/P_2}\right]^{1/2} \quad (8)$$

TABLE 1—SUMMARY OF GAS-FLOW EQUATIONS BASED ON EQUATION 10

FRICTION FACTOR	EQUATION	NAME
EQUATIONS WITH CONSTANT "f"		
CONSTANT	$Q_h = 43.87\ D^{5/2}\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	COX [2]
CONSTANT	$Q_h = 48.61\ D^{5/2}\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	RIN [3]
CONSTANT	$Q_h = 50.03\ D^{5/2}\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	TOWL [4]
CONSTANT	$Q_h = 48.47\ D^{5/2}\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	PITTSBURGH [4]
EQUATIONS WHERE f IS SOME FUNCTION OF DIAMETER		
DIAMETER FUNCTION $f = 0.0044\left[1 + \frac{12}{7D}\right]$	$Q_h = 42\left[D^{5/2} + \frac{D^3}{30}\right]\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	OLIPHANT [5]
	$Q_h = 3.30\left[\frac{D^5}{0.0044\left(1 + \frac{12}{7D}\right)}\right]\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	UNWIN [6]
$f = \frac{0.008}{D^{1/3}}$	$Q_h = 36.93\ D^{8/3}\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	WEYMOUTH [7]
DIAMETER FUNCTION	$Q_h = 59.93\left[\frac{D^5}{1 + \frac{3.6}{D} + 0.03D}\right]^{1/2}\left[\frac{P_1^2 - P_2^2}{L}\right]^{1/2}$	SPITZGLASS [8]
$\frac{1}{f} = \left(\frac{QG}{D}\right)^{0.1461}$	$Q_h = 435.87\left(\frac{T_b}{P_b}\right)^{1.0788} D^{2.6182}\left[\frac{P_1^2 - P_2^2}{\text{Expansion}\ L_{TL}}\right]^{0.5394}$	PANHANDLE [9]
$\left(\frac{1}{f}\right)^{1/2} = 16.7\,\frac{QG}{D}^{0.01961}$	$Q_h = 737\left(\frac{T_b}{P_b}\right)^{1.02}\left[\frac{P_1^2 - P_2^2}{G^{0.961} L T_f}\right]^{0.510} D^{2.530}$	MODIFIED PANHANDLE [10]
FORMULAS WHERE f IS FUNCTION OF REYNOLDS MODULUS		
VALUE OF f IN EQUATION 10		NAME
$f = 0.0048\left[\frac{3600 \times 53.33 T_b}{144\ Q_h G P_b}\right]^{1/7}$		FRITZSCHE [11]
$f = 0.0018 + 0.153/\left(\frac{DvG}{\mu}\right)^{0.35}$		LEES [12]
$f = 0.08/\left(\frac{DvG}{\mu}\right)^{1/4}$		WHITE [13]
$f = 0.0054 + 0.006\left(\frac{\mu_c}{DvG_L}\right)$		McADAMS AND SHERWOOD [14]

In the above equations:

Q_h = flow rate of gas, std. cu. ft. per hour of 0.6 sp. gr. gas measured at 14.7 psia. and 60° F., at a flowing temperature of 60° F.

G_L = specific gravity (water = 1.00)
μ_c = viscosity, cp.
μ = viscosity, lb./ft.-sec.

All other units previously noted.

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1 **WELLS**
Control of corrosion, scale, wax.

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If your operation is plagued with any or all of the problems above, check with your Visco Representative. He will be happy to help you every step of the way.

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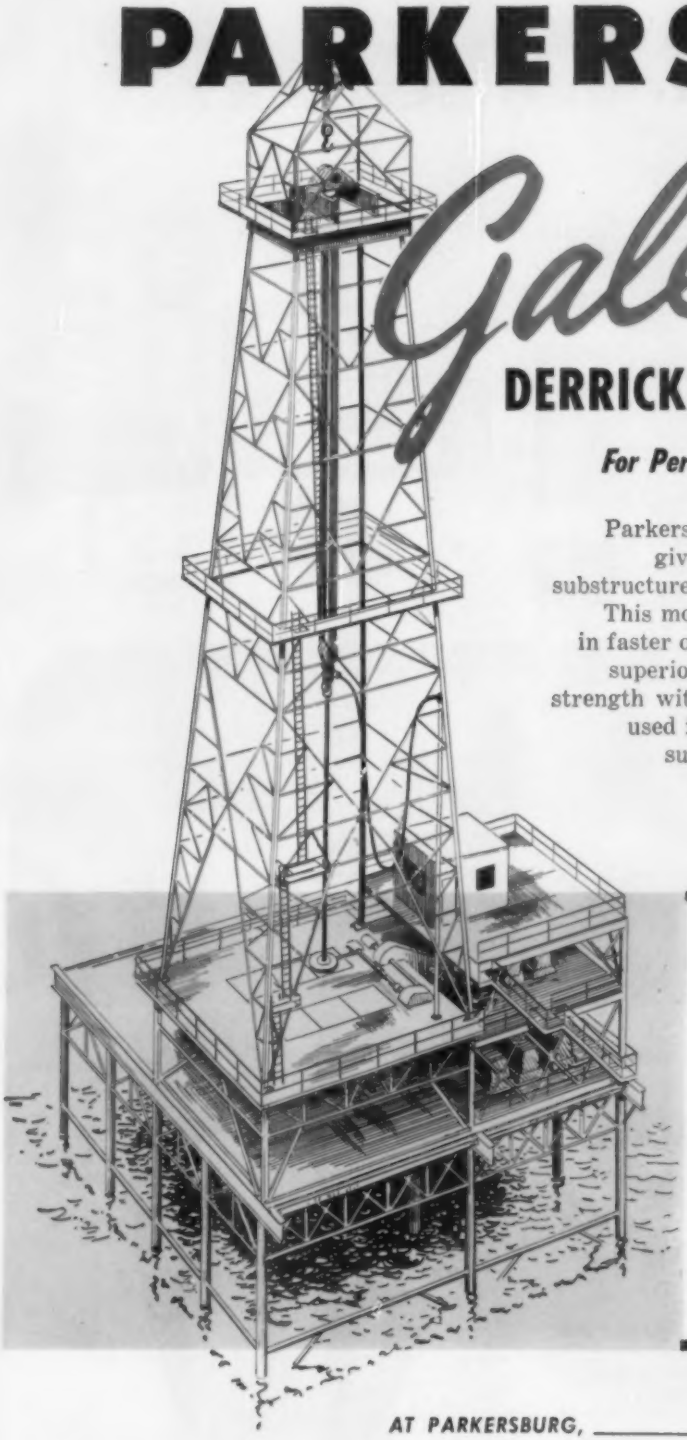
DERRICKS AND SUBSTRUCTURES

For Performance . . . For Flexibility . . . For Economy

Parkersburg, one of the leading names in drilling, now gives you the new Galemaster line of derricks and substructures designed specifically for off-shore operations. This modern equipment offers features that will result in faster operations, more economy and greater safety . . . superior performance in every way. You get maximum strength with less weight. Exclusive "VEE" type bracing used in the Parkersburg Galemaster derrick reduces surface area exposed to wind. All substructures designed for efficient utilization of equipment placement and work space.



6-WELL

You actually roll to more profits with a 6-well Galemaster derrick and substructure. Crown block and beams are unitized on roller assembly to drill three wells in line without using gin pole hoist. To shift block position from one well location to another, jack screws are tightened to force wheels down against top flanges of water table beams and raise crown block supports. Then you quickly and safely move to next hole in line. Arrangement of cross-over sheave guides fast line from center line of derrick to correct position above either row of wells. Gable-type adaption of Pyramid gin pole reduces weight on water table opening. Six-well Galemaster derrick

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PARKERSBURG WEST VIRGINIA

2-WELL DERRICK AND SUBSTRUCTURE

Derrick available in heights of 140′ and 147′ with base 30′ x 30′. Work load capacity 1,100,000 pounds. Gin pole lift capacity, 20,000 pounds. Crown block is lifted with gin pole hoist to move from one location to another.

2-Well Substructure is eight-post type 16′1″ high on 40′ skid centers.

1-WELL SKID-TYPE DERRICK AND SUBSTRUCTURE

Derrick is sturdy, flexible and safe. Available in heights of 140′ and 147′ with base 30′ x 30′. Features exclusive Parkersburg Pyramid gin pole with lift capacity of 20,000 pounds.

1-Well Substructure is eight-post type with distribution of load on double skid beams running from drawworks side to window side. Alemite fittings are provided for lubricating skidding surfaces. All assemblies used with substructure are pin-connected for easy attachment and equipped with lifting lugs. Assemblies are adjustable to accommodate most power and Diesel-electric rigs in any desired position without cutting or welding.

Accessory Assemblies available with the one-well derrick and substructure include engine supports, cantilever motor supports, engine shed, Schlumberger platform, combination pipe ramp and stairways, and wind break shed.

DERRICK AND SUBSTRUCTURE

available in heights of 140′ and 147′ with base 40′ x 45′.

6-Well Substructure available in either six-post or 12-post types with floor heights of 23′ and 16′1″. Corner column capacity is 1,400,000 pounds. Trolley beams furnished for handling equipment used beneath the substructure.

Accessory Assemblies available for both the six-well and two-well derrick and substructure include pipe racking equipment, derrick floor framing, wind break framing, rotary drive countershaft, pipe ramp and stairways, mud collection equipment and cement storage building.

SPECIFY A GALEMASTER DERRICK AND SUBSTRUCTURE FOR YOUR OFF-SHORE DRILLING RIG

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PARKERSBURG

RIG & REEL COMPANY

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where:

M = molecular weight of gas

N = rate of gas flow, weight/unit time

R = gas constant (1,544 ft.-lb./lb.-mole, °F., or equiv.)

Neglecting the log term in the denominator, since it is small in comparison to the first term, yields:

$$Q = K\,(T_s/P_s) \times \left[\frac{(P_1^2 - P_2^2)\,D^5}{fLGT}\right]^{1/2} \quad (9)$$

When written in terms of common pipeline terminology Equation 9 may be written as:

$$Q = (38.77)\,T_s/P_s \times \left[\frac{(P_1^2 - P_2^2)\,D^5}{fLGT_f}\right]^{1/2} \quad (10)$$

where:

T_s = temperature base, °R.

P_s = pressure base, psia.

P_1 = inlet pressure, psia.

P_2 = outlet pressure, psia.

D = internal pipe diameter, in.

L = length of pipe section, miles

G = specific gravity of gas, (air = 1.00)

T_f = gas flowing temperature, °R.

f = friction factor, dimensionless

Q = volume of gas, std. cu. ft./day at T_s and P_s

Friction factor used . . . Most of the common gas flow equations are based on Equation 10 and differ only in the expression used for the friction factor "f." Table 1 summarizes the most familiar equations proposed and the friction factor used. The equations shown are not all that have been proposed but are typical of those that are derived from Equation 10.

These equations may be divided into three general classes:

1. Those based on a constant friction factor.

2. Those where the friction factor is some function of the diameter.

3. Those in which the friction factor is some function of Reynolds modulus ($Dv\rho/\mu$).

Those equations in Class 1 were generally derived for early low-pressure gas systems and have little or no current application. Weymouth's equation and the Panhandle formulas have been most commonly used by the gas industry, although the Oliphant formula[10] is a recent modification that is proposed as being more suitable than the original for high-pressure-diameter lines. The friction factor shown was derived using a typical gas viscosity of 7.4×10^{-6} lb./ft.-sec. If the gas viscosity is substantially different the equation should be multiplied by:

$$(7.4 \times 10^{-6}/\mu)^{0.20}$$

Pipeline Efficiency

Equation 10, the basic flow equation, assumes that the actual line consists of a circular conduit with no restrictions to flow other than pipe-wall friction. In an actual line, however, the presence of liquid, scale, and other foreign substances gives a flow less than that predicted by the equations. In order to correct for this factor it is common to add a multiplying factor E, the pipeline efficiency factor, to all equations.

This factor is a fraction which expresses the actual fraction of the total theoretical flow that will probably flow through a line. It is largely based on experience but Baker and Swerdloff[15] suggest the following for gas-gathering systems:

Type line—	Liquid (gal./M.M.c.f.)	E
Dry-gas field	0.1	0.92
Casing-head gas	7.2	0.77
Gas and condensate	800	0.60
Casing-head gas and crude oil	9,000	0.31
Casing-head gas and crude oil	52,000	0.04

The latter two cases really fall into the range of two-phase flow equations and are probably best solved by them rather than applying a substantial correction to a gas flow equation. In most pipeline applications the factor E ranges from 0.85 to 0.95 in a "clean" line.

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BOOKS

UTAH'S ECONOMIC PATTERNS by Elroy Nelson. Published by University of Utah Press, Salt Lake City, Utah. 345 pp.

The purpose of this book is to provide information about Utah for (1) students and teachers in social science, (2) management of industrial and commercial companies in Utah, (3) officials of government, (4) others with vital interests in Utah's development.

Organization of the book is based on the premise that most of us are interested, first, in our immediate geographic and economic surroundings; second, on the premise that the procedures in learning the social sciences can begin at home, extending from the generally known immediate surroundings to the more remote.

Usually specific data are lacking on a state level of economics. This book is intended to fill that void.

MANAGEMENT GUIDE TO OVERSEAS OPERATIONS edited by Dan H. Fenn, Jr. Published by McGraw-Hill Book Co., Inc., 330 West Forty-second Street, New York 36. 308 pp. $4.50.

This book is a well-organized, compact summary of the principal issues which face the American firm in the foreign field. The problems and possibilities for small and large firms, and implications for the survival of capitalism and for the cold war, are surveyed.

Helpful information is given on foreign trade. Problems, techniques, and possibilities for American businessmen have been edited from talks and discussions at the Twenty-sixth Annual National Business Conference of the Harvard Graduate School of Business Administration.

Many facets of overseas programs are covered including personnel management, control, public relations, labor relations, determining whether to license, export, and manufacturing. A large number of case histories from a variety of companies offer practical guidance to the executive who is thinking about international markets.

AUTOMATION IN BUSINESS AND INDUSTRY, edited by E. M. Grabbe, published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 611 pp. $10.

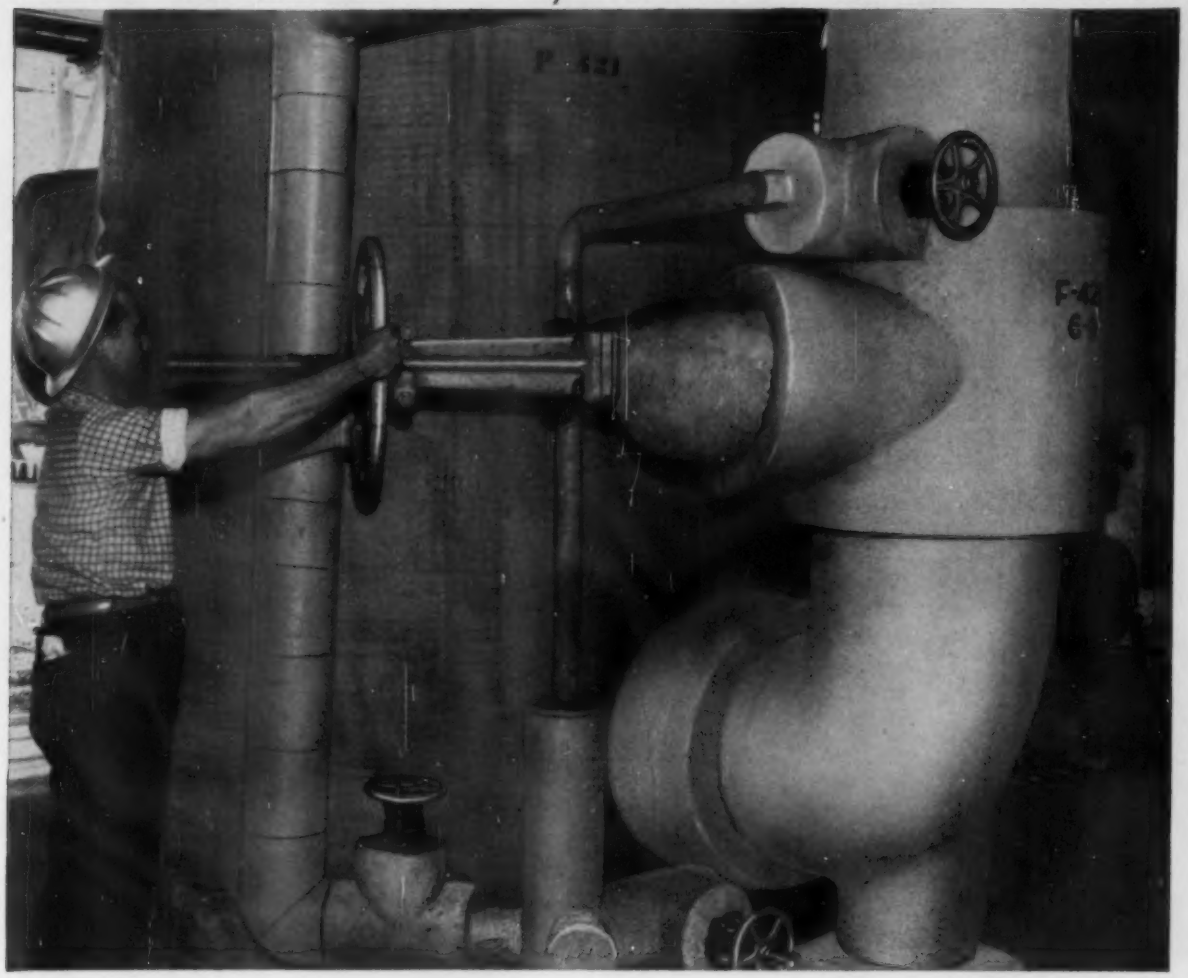
The book is based on a series of lectures given by a number of prominent engineers and scientists at the University of California. It supplies a wealth of information and detail on the fundamentals of automation, new developments in automation techniques, and descriptions of automation system applications.

The work shows how the fields of feedback control theory, instrumentation, analog and digital computation, and data processing are now becoming integrated as automation is applied on a broad scale to control systems from top management to individual machines.

Emphasis is placed on those applications of control systems which can perform both complex control functions and data processing. As a result, considerable attention is paid to electronics, computers, and data processing. Components are treated early in the book and systems later.

The book answers the questions: "What is new?" and "How is it used?" Each of the authors has reviewed automation developments in his special field with liberal use of examples. Although the treatment is general rather than technical, much detailed and valuable information is given.

Hard to Beat in Any Service—Crane Valves



Distinguished in Service on hard-to-hold fluid in petrochem processing

Some fluids by nature are appreciably harder to hold than others, even at low pressures and temperatures. One such fluid is cuprous ammonium acetate, being handled as shown here with a Crane 14-in. steel wedge gate valve.

This installation is at Petroleum Chemicals, Inc., a large butadiene plant at Lake Charles, La. Working pressure is less than 50 p. s. i. and the temperature is under 32 F°.

The low line pressure against the disc when closed, doesn't help much to keep the valve tight. Leakproof closure on the fluid depends entirely on the quality of bearing surface finish, the preciseness and accuracy of disc travel, and resistance of seating members to corrosion.

That's how this Crane 47X gate valve has been holding tightly on this penetrating fluid since 1944, with still no sign of seat leakage. And the only maintenance given it has been routine repacking at turnaround every one or two years.

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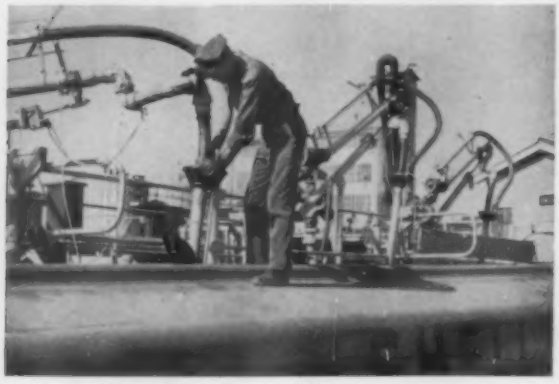
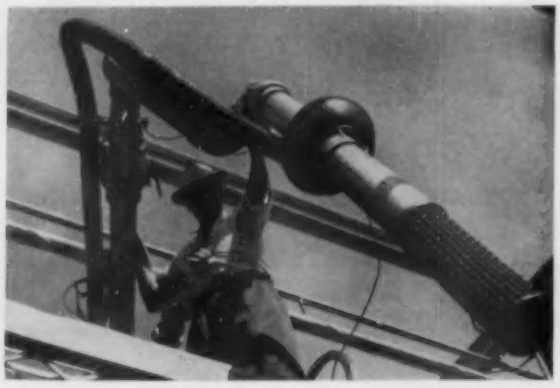
SEVERAL NEW IDEAS have been put to work at this loading rack. Water-jet grounds have been installed to carry away static electricity.

THESE JETS of water are directed vertically upward against the truck's tank. A water-fog-spray system has been installed.



LOADING IS EASY on this new rack of Shell's. Vapors are forced through return line into refinery fuel system and burned.



A RUBBER SEAL prevents a truck load of gasoline vapors being vented to the air. Filling spouts are moved by air.

This Truck-Loading Rack Fights Fire Hazards

. . . Its design includes several new ideas on safety

AT a cost of approximately $150,000, a new truck-loading rack has been completed recently at Shell's Wilmington refinery for the loading of aviation gasolines, jet fuel, kerosine, diesel fuel, and spcialty products such as solvents and paint thinners.

This replaces the rack destroyed by the flash fire of December 12, 1954. Shell engineers spent considerable time studying and planning for this project before the rack was designed. In this connection they came up with a truck-loading rack that contains several new ideas. Ease of operation, safety, and air-pollution control are included in the design.

Air cylinder . . . Some of the filling spouts are lowered and raised in and out of the top of the truck with an air cylinder. The cylinder is controlled manually. The operator must open or close a small valve to raise or lower the spout—that's all. This device makes the work of the loaders easier. The air cylinder also helps to hold the rubber plug used for vapor recovery tightly against the top openings in the rack. This insures against leakage of vapors.

Safety stressed . . . New safety features have been used in the rack design. In addition to the conventional grounding connections, which consist of grounding wires clamped to the tank trucks by the operator, water jet grounds have been installed at all loading positions. These jets of water are directed vertically upward against the truck's tank and carry away static charge. The tank is grounded to help guard against fires started by static electricity.

New fire-fighting equipment and facilities have been added also. A water-fog-spray system has been installed over the new rack and all adjacent racks. The fog system can be turned on manually at any of several control points. Within seconds, the

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TRIMULSO is a surfactant, emulsifier and corrosion inhibitor used to make oil-in-water emulsions for clear water drilling and low solids mud.

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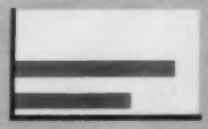

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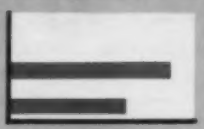

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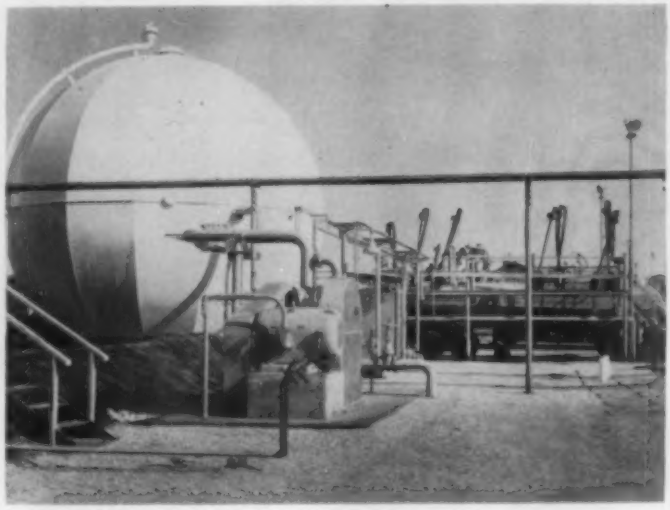
entire area can be covered with heavy fog of about 1,600 g.p.m. which will cool and smother fire.

The new drainage and paving system is designed to carry away quickly any product spillage. And it will help to prevent fire from spreading by removing water and oil as rapidly as possible after it strikes the paving.

Vapor-recovery devices . . . As a part of the air-pollution - control program to reduce hydrocarbon-vapor emissions to the atmosphere to a minimum, all loading spouts handling products over 1½ psi. are equipped with vapor-recovery devices. Vapors from empty truck tanks are forced through a collection system by the incoming products. The vapors are then collected in a vaporsphere, compressed, and finally burned in furnaces.



VAPORS are collected in the white sphere then fed to the refinery.

Bay Refinery Meets Water Crisis

By F. J. Tiernan

ABOUT 1 mile from where the Saginaw River flows into Saginaw Bay is the location of Bay Refining Corp.'s Bay refinery. When a strong southwest wind comes up, it blows from the bay out into the lake taking the river water with it. The refinery gets all its cooling water from the river through a slip used for cooling-water intake. The slip was dug when the plant was built in 1937.

On an afternoon in mid-November 1956, the wind started blowing from the southwest and in 4 or 5 hours the wind had reached 60 to 70 m.p.h. By this time the river level had dropped 7 ft. and a mud bank which had built up at the mouth of the slip would not let water flow. At this time with the river level 7 ft. below normal, our cooling-water pumps lost suction. Our first thought was to keep the plant operating.

Bay has two crude-distillation units with a total crude charge of 11,000 bbl. per day. The overhead condensers are the coil-in-box type of condenser. The bottoms and all the side streams exchange heat with the crude charge and by doing so are cooled considerably.

Desalting process . . . The water which is used in the desalting process is taken from the overhead condenser box. The desalter water pump was shut down to keep from pumping all the water out of the box.

The crude charge was cut back to 5,000 bbl. per day and the side streams were adjusted accordingly. Nineteen hours later the wind quit blowing and the water came back into the river. In an hour the plant was back to normal.

Ten days later when the same thing happened we knew what to do. To do a better job when the wind had blown the river out to about 5 ft. below normal we channeled the water returning from our cooling box to the river bank into the intake slip. The wind continued to blow and when the river reached 6 ft. below normal the yard crew manned shovels and dug a trench through the mud bank at the slip inlet. This let some water come in. With this water and the water returning from the cooling boxes we were able to keep the crude units operating at full capacity.

The catalytic cracking unit which is equipped with shell-and-tube condensers and takes water from the same slip could not operate at normal capacity. The charge to this unit was reduced by two-thirds of the normal capacity and all product streams and equipment were allowed to run a few degrees above normal temperatures.

The normal amount of water pumped to the cracking unit is 3,750 g.p.m. and during this emergency the amount was reduced to 280 g.p.m. To supplement this amount, two pumps with a capacity of 500 g.p.m. were installed at the water-oil skimming trap and the water was recirculated instead of being discharged into the river some ¾ mile north of the intake.

Author is superintendent, Bay refinery, Bay Refining Co., Bay City, Mich.

SCREEN on top of this air-cooled exchanger prevents damage to fins by hail at West Texas Gas Co.'s Turkey Creek plant, Fritch, Tex.

The Dowell engineer's signals coordinate the operation of the pumpers and blenders on this fracturing treatment.

PETROJEL

Effective fracturing at low cost for quick payout

Petrojel* uses your own lease crude, modified on location with a gelling agent to give it high sand-carrying capacity. The result is an effective, low-cost fracturing fluid designed for quick payout. When crude oil is not available, kerosene or diesel fuel may be used.

The gelled crude has lower surface tension than the original base oil. It does not lose its viscosity when it is pumped through sand, and it has naturally low fluid loss. Thus, Petrojel gives you the full benefit of deep sand penetration plus easier return of the fluid after treatment.

The fluid used in Petrojel resists thinning at temperatures up to 200° F., making it especially effective in high-temperature wells. It is also an ideal treatment for gas wells or oil wells with low bottom-hole pressures.

Regardless of the treatment your well requires, you can depend on Dowell's research facilities, experienced personnel and advanced equipment to give you the best results.

For more information, or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service, or write to Dowell Incorporated, Tulsa 1, Oklahoma.

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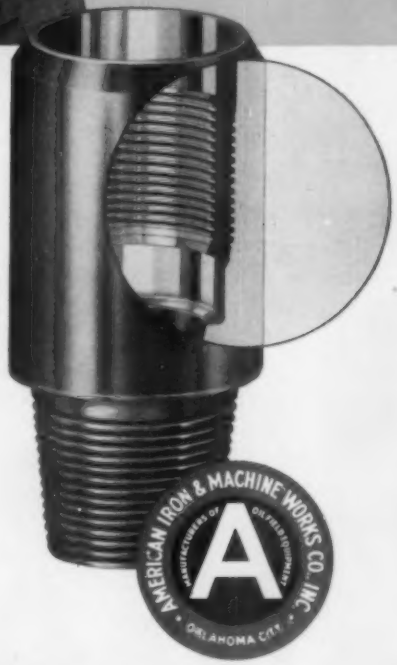
Knowing a tool joint means knowing and depending on what it will do under all conditions, good and bad . . . knowing that it will not torque off; that under extreme high pressures the pipe threads will hold a seal; that the tool joint will withstand more punishment than the pipe; that quick replacements are available and will be installed right at the rig . . . and knowing that Straight Grip is the finest available.

Men who *know* tool joints specify Straight Grip from experience. Longer life, trouble-free operation, additional footage at less per-foot cost, plus the guarantee of satisfaction because it's American Iron.

When you make *your* next tool joint purchase, specify American Iron Straight Grip . . . you'll be buying experience and reliability.



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After 3 years of testing in Canada, Imperial Oil reports:

Water Still Poses Tough Problem In Drilling With Air

By A. Scovil Murray and Stan P. MacKay

ONE of the most aggressive drilling investigations that has ever been attempted by technical personnel is currently holding the attention of major operating companies and contractors in North America. Industry has been drilling with compressed air or natural gas for over a decade and many economies have been reported in areas where dry formation has been drilled.

For example, data from drilling experiments conducted in Pennsylvania where formations are dry to the producing interval, are of particular interest. (Fig. 1). Conventional and jet-bit drilling tests with mud circulation are compared with wells where air was used as the circulating medium. Penetration rate in the air-drilled wells was doubled compared with the jet-bit test. Footage per bit was increased approximately 52 per cent.

There are many other examples such as this. Yet the fact remains that after 10 years of drilling with air or natural gas, industry has only been able to penetrate dry formation. Until recently it was not known why air drilling was successful in penetrating dry formation at higher

What Imperial learned from tests . . .

Imperial Oil's air-drilling tests in western Canada have covered the relatively unexplored region of drilling where fluid ranges from air to aerated water.

Water influx of 100 bbl. per hour was found the maximum for economic air drilling. With foam injection, drilling proceeded with water influx of 500 bbl. per hour. However, penetration rate when air lifting 500 bbl. per hour was no greater than the rate when drilling with mud.

Important observations during these tests were:

1. **In medium-to-soft shale** formations . . .

. . . **Despite 900-psi. pressure capacity,** lifting wet cuttings and preventing bridging with only air injection was impossible.

. . . **Hydrating and excessive sloughing** of the shale could not be prevented when water and/or foam was injected with air.

. . . **Hole enlargement** was noted when drilling dry formation and circulating only air.

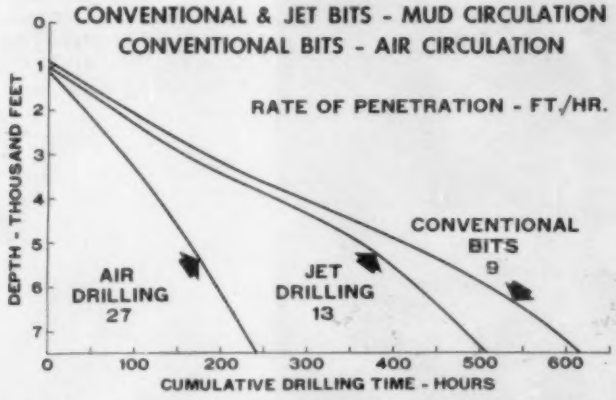
. . . **Penetration rate and bit life** were improved by 1½ times when drilling dry formation.

2. **Competent formation** was drilled with the simultaneous injection of water and foam beyond the point where water influx was so great that there was no longer any penetration-rate advantage.

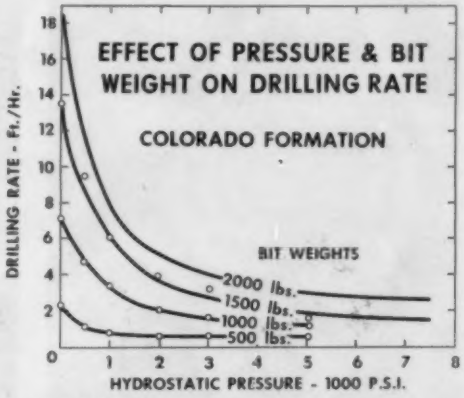
3. **Variations in table speed, bit weight, and circulation rate** produced the same effect as in conventional mud drilling.

4. **Penetration rate declined** when air velocity at the bit was reduced.

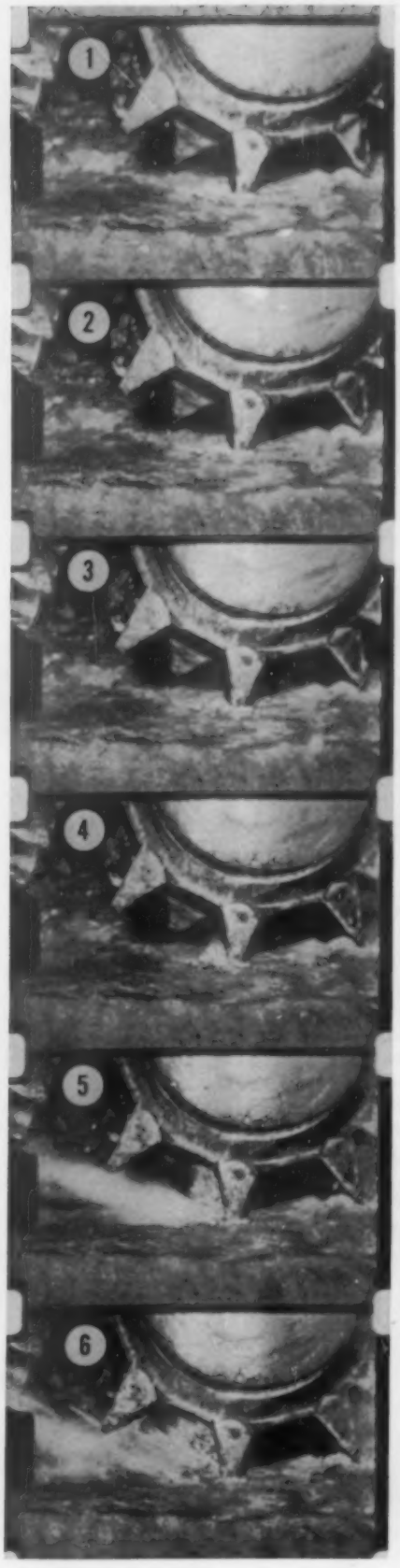
5. **Repair and maintenance costs** were excessive on single-acting trunk and piston-type compressors.

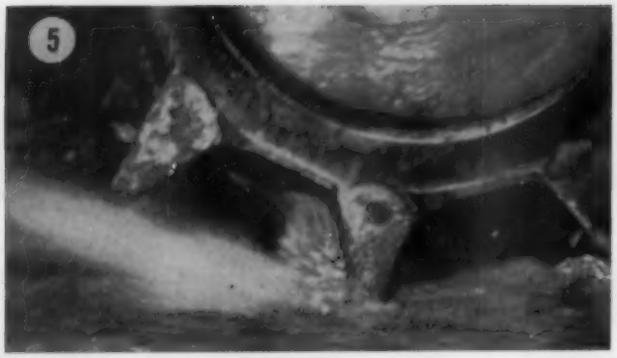

CONVENTIONAL & JET BITS - MUD CIRCULATION
CONVENTIONAL BITS - AIR CIRCULATION
RATE OF PENETRATION - FT./HR.
DEPTH - THOUSAND FEET
CONVENTIONAL BITS 9
AIR DRILLING 27
JET DRILLING 13
CUMULATIVE DRILLING TIME - HOURS

TYPICAL COMPARISON of mud and air circulation for Pennsylvania shows the advantage of air drilling. In dry formations, the air drilling rate was three times that of mud drilling with conventional bits. Fig. 1.

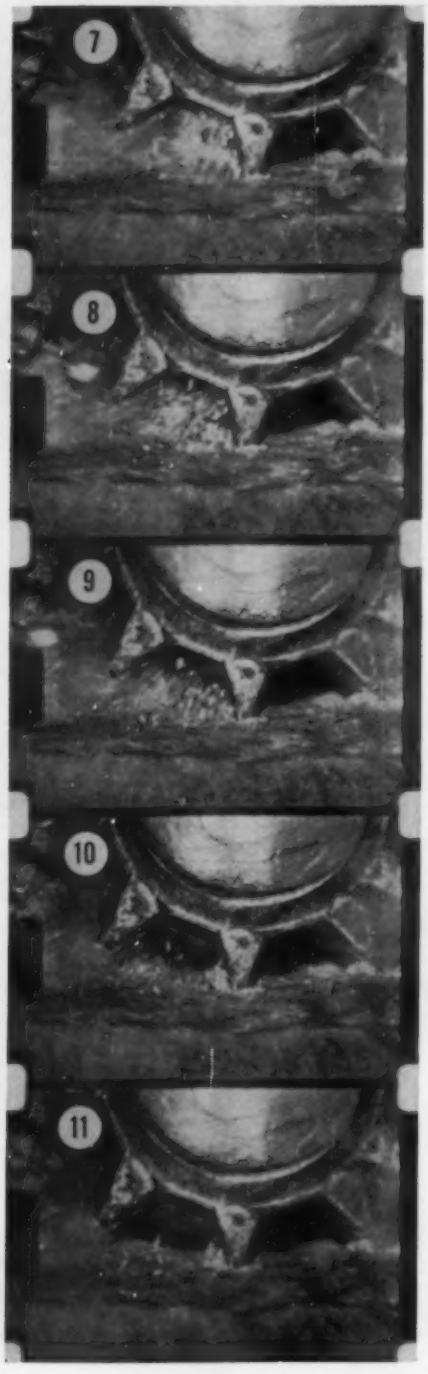


ADVANTAGE of air drilling is in part due to decreased pressure on the formation. This effect is typical of results obtained by Imperial and Hughes Tool Co. on many types of rock. Fig. 2.



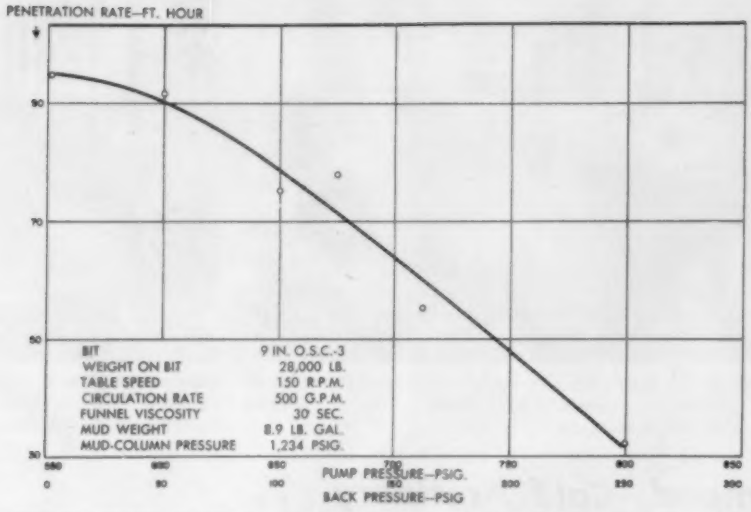


FAILURE is explosive when bit pressure finally exceeds strength of rock.



Camera Shows Mechanism of Rock Failure

THIS sequence of pictures shows how a rock-bit tooth breaks rock. Conditions are atmospheric pressure with cuttings being blown away by air. Starting in Picture 1, a tooth starts to apply pressure to the rock as the cone rolls forward. The rock does not break immediately. Then in Picture 4, the pressure of the tooth exceeds rock strength and failure starts. The failure is practically an explosion of rock. Chips continue to fly as the tooth sinks deeper. Finally, by Picture 10 particle discharge diminishes and then ceases. Filmed by Hughes Tool Co. with a 9¾-in. O.S.C.-3 bit cutting Berea sandstone.



DRILLING-FLUID HEAD decreased penetration rate in this drilling test of the Belly River formation, Joffre area. Test depth was 2,635 to 2,697 ft. Fig. 3.

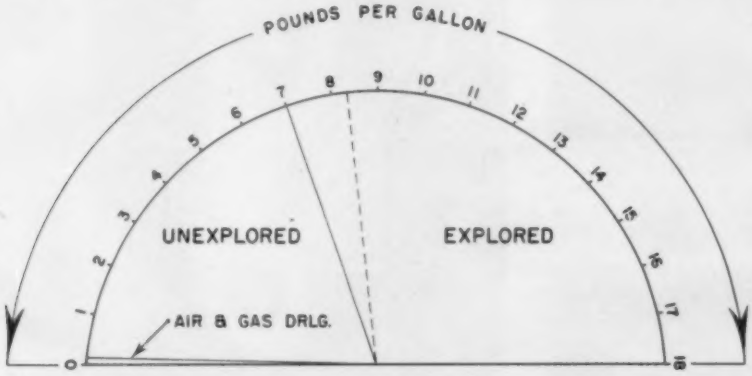
rates and with increased bit life as compared to mud circulation.

Research results . . . Imperial Oil and Hughes Tool Co.[1], over a 3-year period, investigated some of the fundamental factors affecting penetration rate. The effect of overburden pressure, drilling-fluid head and bit weight on rock drillability were studied. Rock from the Canadian Plains area was subjected to pressures ranging from atmospheric to 8,000 psi. and the effect of these pressures was noted.

The results were consistent with other work—rock strength was found to increase with pressure although there was no correlation between these increases in strength and actual depth of burial. These investigations also showed that within the range of conditions normally encountered in drilling, some rocks which are brittle under lower pressures become plastic.

In order to investigate the effect of physical changes that occur in rock under pressure on penetration rate, Hughes Tool Co. built a drilling machine which would approximate bottom-hole conditions. Penetration tests were made on cores from all of our major plains formations at variable bit loads to 2,500 lb. and under variable hydrostatic pressures to 8,000 psi. Results of these tests on the Colorado formation are typical, (Fig. 2). They indicate the following:

1. As hydrostatic pressure increases, drilling rate decreases.
2. The greatest change in drilling rate occurs under low hydrostatic pressure.



SLIP VELOCITY OF A SPHERE IMMERSED IN A FLUID:

$$V_s = 2.67 \left(\frac{d\,P_p}{P_f}\right)^{1/2}$$

DENSITY RANGE of drilling fluids shows an area that is practically unexplored. Imperial examined this region in finding the effect of water influx on air drilling. Fig. 4.

ALBERTA AIR DRILLING by Imperial has been conducted in the above areas. Twelve tests have been completed. Fig. 5.

3. Decreased drilling rates due to increased hydrostatic pressure can be partially offset by increased bit weight.

Field Tests of Pressure Effect

Imperial confirmed these laboratory findings by actual field tests where a kelly packoff and a valve on the flow line were used to control circulation pressure. Results from tests on the Belly River formation are shown in Fig. 3. These studies indicated that substantial increases in penetration rate could be made if bore-hole pressures could be kept low. Air or natural-gas circulation was the logical means of doing this.

Prior to describing our air-drilling experiments, a study of the density range of fluid phase combinations which are suitable as drilling fluids would be helpful. (Fig. 4). Industry has explored the section from 7 to 18 lb. per gal. This section includes:

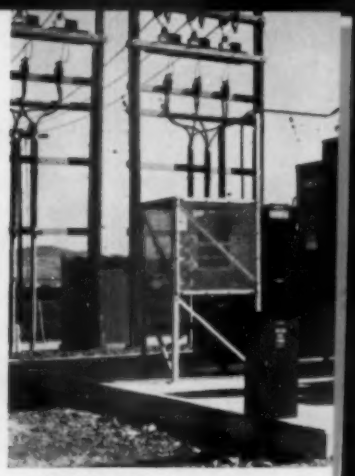
1. Crude oil which weighs approximately 7 lb. per gal.
2. Unweighted oil-base muds weighing approximately 7.8 lb. per gal.
3. Water which weighs 8.33 lb. per gal.

THE AUTHORS

A. Scovil Murray is regional drilling engineer with Imperial Oil, Ltd.'s producing department at Calgary, Alta. He started work with Imperial as a roughneck in 1943. In 1948, he received a B.S. degree in petroleum engineering from University of Tulsa. Upon graduation he joined Venezuelan Atlantic Refining Co. After 2 years of field work in Venezuela he returned to Imperial to set up a new section concerned with drilling research.

Stan P. MacKay is a drilling engineer with Imperial. He graduated from University of Oklahoma with a B.S. degree in petroleum engineering in the spring of 1950. Upon graduation he joined Magnet Cove Barium Corp. as a mud-service engineer in western Canada until early in 1955.

BUILT IN 14 MONTHS by The M. W. Kellogg Co., new ammonia plant is a unit of Standard's Richmond refinery, one of West's largest. All electric equipment is by General Electric, which also provided engineering service to help achieve fast start-up.

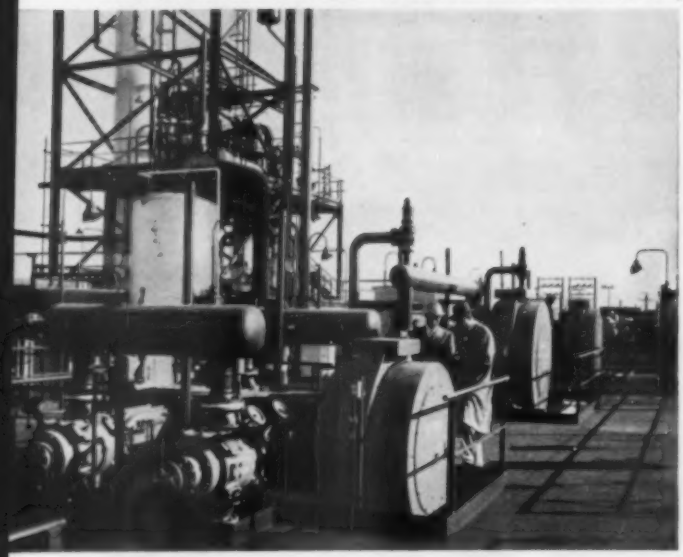


CO-ORDINATED for top reliability, G-E equipment in master substation for ammonia

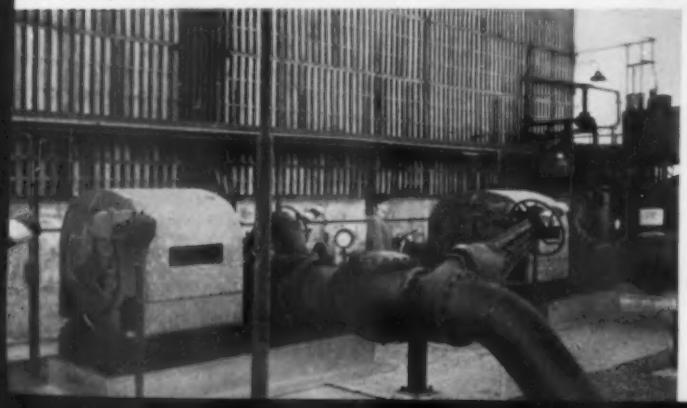
At Standard's Richmond, Calif., refinery . . .

General Electric engineering services help

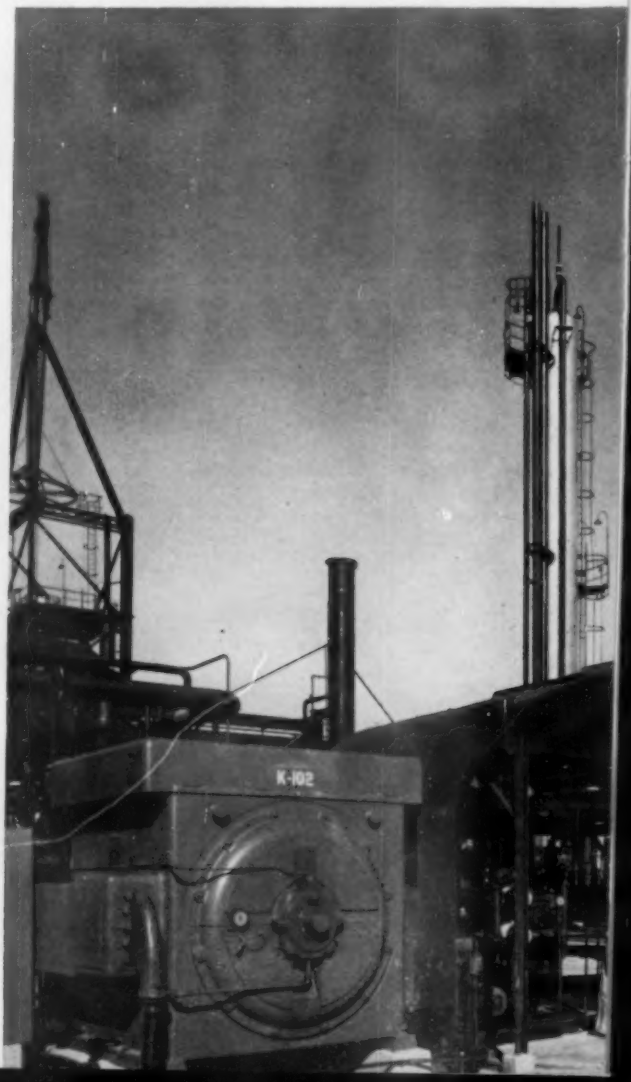
OUTDOOR-LOCATED on platform to drive compressors are 8 high-efficiency, enclosed, force-ventilated G-E synchronous motors (3 shown) with excitation obtained from substation's d-c m-g sets.

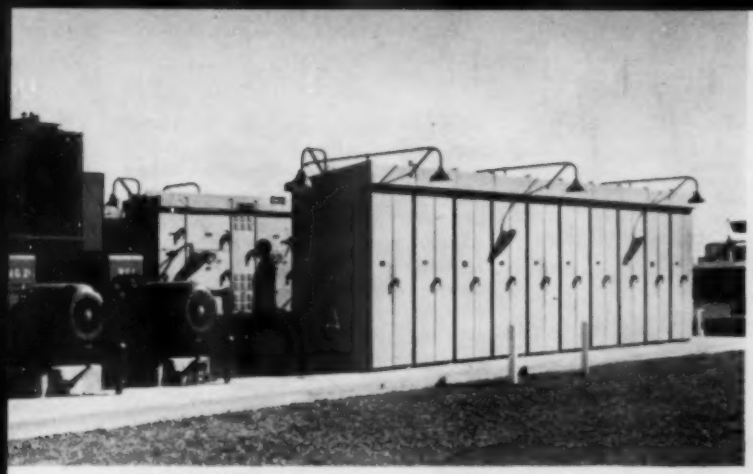


WEATHER-PROTECTED, 2 rugged 350-hp G-E induction motors drive cooling-water pumps. Other plant induction motors are either enclosed force-ventilated or explosion-proof, fan-cooled. ▼



PLANT'S BIGGEST, a 4000-hp 12,000-v totally enclosed force-ventilated G-E induction motor drives synthesis gas compressor. Explosion-proof 60-hp G-E motor (r.) drives blower





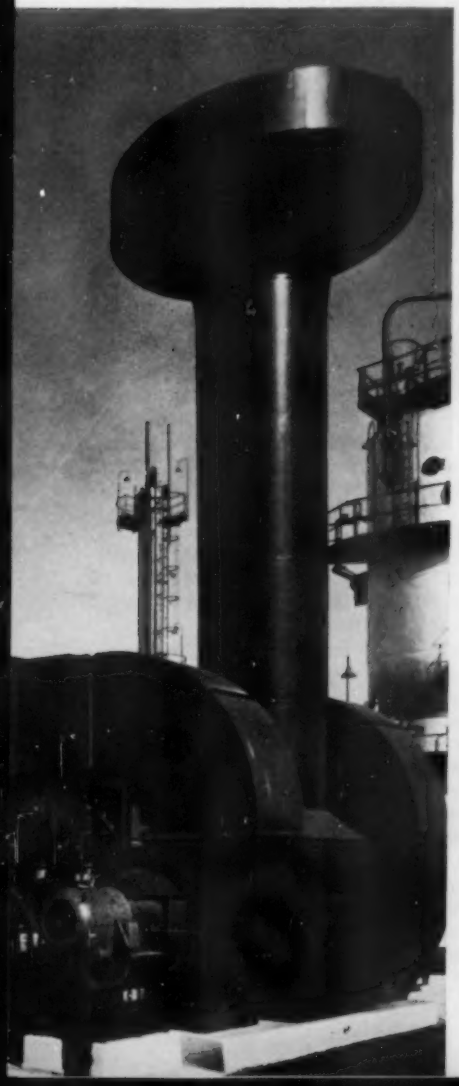
plant includes 5000-kva transformer, 17 units of 12-kv metal-clad switchgear, 2300-v Limitamp* motor starters, 480-v outdoor motor control centers, 2 outdoor motor-generator sets, and two 480-v transformers.

*Registered trade-mark of General Electric Co.

EASY MAINTENANCE of plant's G-E metal-clad switchgear is shown by workman removing vertical-lift, magne-blast circuit breaker for inspection.

speed opening of 300-ton/day ammonia plant

drawing clean air—via black ductwork and mushroom tower—from upper level of uncontaminated atmosphere.



General Electric power system, installed to meet rigid construction schedule, helps plant get fast start on profitable production

Standard Oil Company of California, Western Operations, Inc., recently added to its Richmond, California refinery—the largest west of the Rockies—a new $11 million ammonia plant designed, engineered and built by The M. W. Kellogg Co. The plant's capacity of approximately 300 tons per day of anhydrous and aqueous ammonia is shipped to nearby California Spray Chemical Corp., a subsidiary, for conversion into fertilizer.

GENERAL ELECTRIC supplied the new plant's electric equipment—compressor drives, auxiliary motors, and complete outdoor substation with co-ordinated components. In addition, General Electric engineering services helped both customer and designer get the new plant from the discussion stage to on-stream in only 14 months.

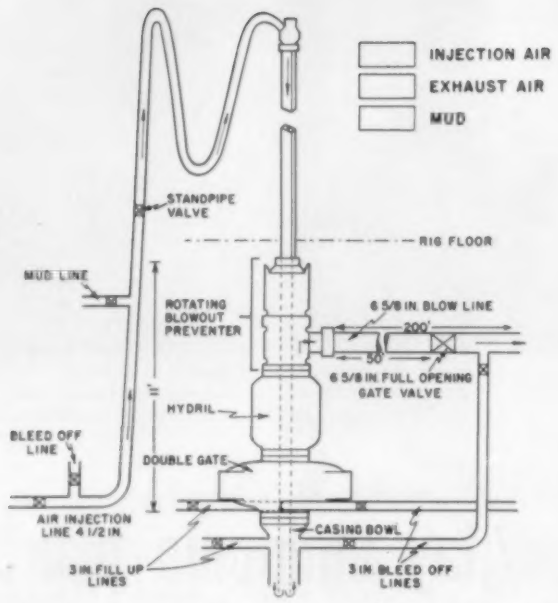
An example was the contribution of General Electric installation and field service engineers. By supervising the installation of the electric equipment as scheduled deliveries arrived, they helped reduce field installation costs, speed completion of construction schedules, and hasten start-up time. To Standard, this meant getting into production faster, and thereby, showing a return sooner on the large capital investment tied up in the plant.

IN ADDITION, the 17,000-kva block of power will be integrated into the existing plant system. General Electric application engineering services, working closely with Standard and Kellogg representatives, helped provide the electrical equipment co-ordination and integration necessary to meet the plant's process power requirements.

For *your* new chemical plant, too, General Electric offers a one-manufacturer source of quality electric equipment and valuable engineering services to help provide you and your process contractor with an efficient, co-ordinated electrical system. Early in your planning, contact your nearest General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. 662-49

Engineered Electrical Systems for the Process Industries

GENERAL ELECTRIC



AIR-DRILLING ASSEMBLY used in Imperial's test provided maximum well control. Fig. 6.

4. Conventional water-clay muds weighing between 8.5 and 11 lb. per gal.

5. Water-clay and oil-base muds which may be weighted with barite to 18 lb. per gal.

Low densities . . . Air and gas drilling is being investigated in the lowest density range from 0.005 to 0.015 lb. per gal. The unexplored section represents those single or multiphase fluids which fall between 0.015 and 7 lb. per gal. Phillips Petroleum Co. has done considerable investigation within this range by injecting air into a mud stream[2]. This is known as aerated-mud drilling.

Imperial has been studying the application of air drilling in western Canada since August 1955. Twelve tests have been completed. Wells were selected to provide a range of drilling conditions which would be representative of the western Canada area. (Fig. 5).

About 80 per cent of the section is shale. Laboratory work with Hughes Tool had shown that penetration rates would increase when bore-hole pressure decreased.

The first six tests were conducted in the Red Deer area where 90 per cent of the formation is soft shale and where electric logs indicated an absence of formation water.

Techniques . . . Four compressors with a maximum pressure rating of 200 psi. were used. A drilling-head assembly was designed for maximum well control. (Fig. 6).

All tests were abandoned when water-bearing formation was encountered and the pressure capacity of the compressors was insufficient to remove wet cuttings. Several techniques were investigated to overcome bridging. A waterproofing chemical was used without success.

Hot air was injected directly from the compressor discharge manifold but heat losses were too great in the drill pipe and surface lines to be of benefit in the hole. A foaming agent was used but there was not enough formation water to make a good foam. Slugs of water or mud were injected to free the pipe but the pressure limitation of the equipment prohibited full development of this technique.

Hole size was reduced to increase annular velocity in an attempt to lift wet cuttings. This was also unsuccessful. These tests showed:

1. Cuttings had to be dispersed before they could be removed from the hole.

2. Higher-pressure equipment was necessary.

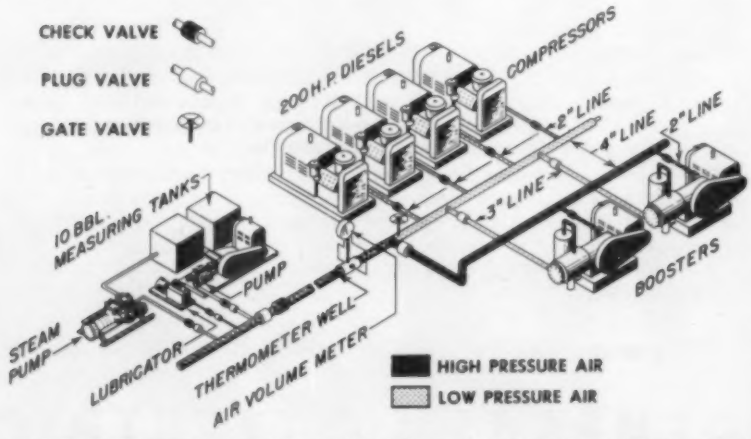
Pressure boosters . . . The second phase of the investigation was undertaken using four compressors and two booster units. (Fig. 7). This equipment permitted continuous air circulation rates of 1,800 cu. ft. per minute at 100 psi., 1,400 cu. ft. per minute at 300 psi., and 800 cu. ft. per minute at 900 psi. When additional pressure was needed, the units were operated up to 1,200 psi. for short periods.

Field tests were conducted to investigate penetration rate and hole condition when drilling wet formation with the injection of water and/or a surface-active agent into the air stream so that air remained the primary phase.

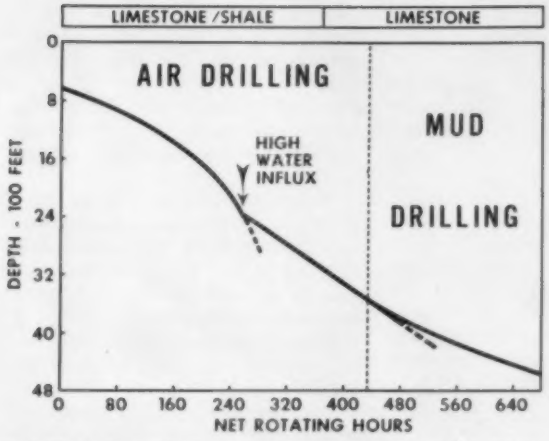
Fluid head varied from an equivalent density of 0.005 lb. per gal. to approximately 5 lb. per gal. This was governed by formation factors, particularly water influx rate.

Water-foam injection . . . In experimenting with water and foam, injection rate was governed by both formation-water influx rate and penetration rate. A concentration of 0.1 per cent surface-active agent mixed with water will produce a good foam. Injection rate has varied between 5 bbl. of water per hour with ½ gal. of foam and 20 bbl. of water per hour with 20 gal. of foam.

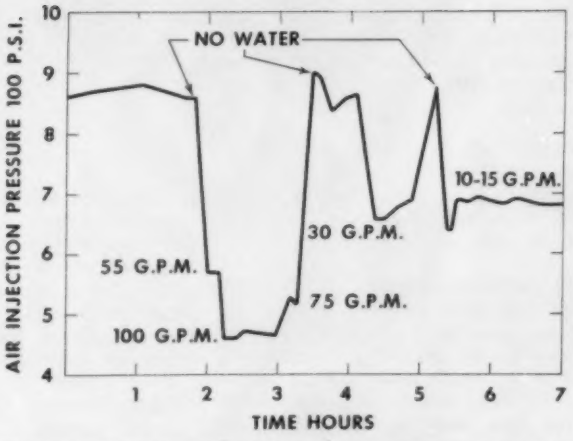
Many types of surface-active agent have been investigated. Selection of foaming agent depended on the unit



COMPRESSORS were connected to provide 1,800 cu. ft. per minute at 100 psi. or 800 cu. ft. per minute at 900 psi. Pumps permitted water and foam injection. Fig. 7.



PENETRATION RATE at Scalp Creek suffered as the hole began to produce water. Rate was same with mud and with air when water entered at 500 bbl. per hour. Fig. 8.



WATER INJECTION reduced the air injection pressure when hole was making water. This method permitted drilling with air without exceeding compressor capacity. Fig. 9.

cost per pound and per cent active ingredient. Special foams were available for salt water and low temperature.

It was possible to remove the small flows of fresh water in competent formations to a depth of 2,000 ft. at Imperial's Scalp Creek well using air only at pressures up to 300 psi. (Fig. 8). Below 2,000 ft., slug flow and erratic pressures were encountered as water influx increased. This condition reduced penetration rate. Injection of a surface-active agent into the air stream using water as a carrier, stabilized and reduced pressure and aided continuous returns.

Water influx of 100 bbl. per hour was measured at 2,100 ft. Although this was considered a maximum condition for economic air drilling, testing was continued to 3,500 ft. where formation-water production had gradually increased to 500 bbl. per hour. Foam injection became uneconomic and water disposal a problem.

Air injection pressure reached the limit of compressor design at 900 psi. Tests were then conducted to reduce this pressure by injecting water at various rates. (Fig. 9). Injection of 100 g.p.m. reduced pressure against which the compressors operated to 460 psi. This method would have permitted drilling with lower pressures to greater depths.

The water-foam injection technique was investigated in drilling wet, medium-to-soft shale formation. It was successful in dispersing and lifting wet cuttings but caused excessive sloughing which eventually stuck the drill pipe.

Water shutoff investigation . . . Two attempts were made to shut off formation water in fractured limestone. These tests were unsuccessful. Several materials which appeared to have a field application to the problem of water shutoff were studied in the laboratory. Field testing has been restricted pending the development of suitable equipment, placement technique, methods of locating water zones and lower cost.

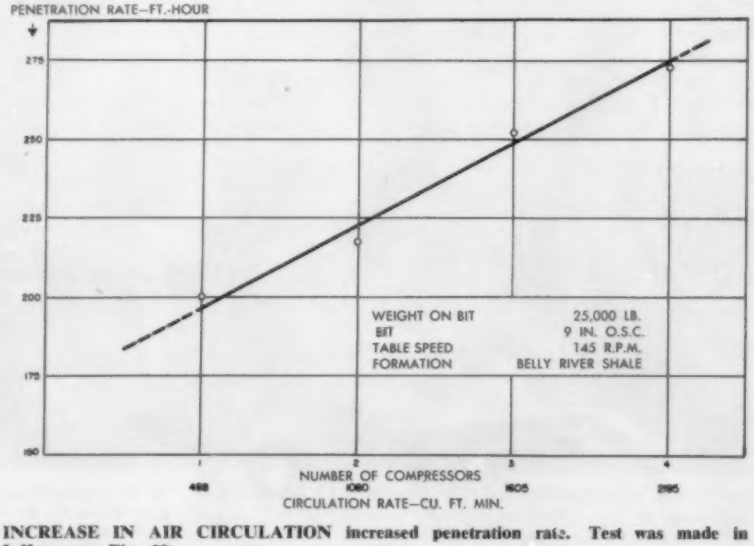
Penetration rate . . . Our field tests have indicated that drilling rate was linearly related to table speed, weight on bit, and air circulation volume when penetrating dry, medium-to-soft shale formation. This relationship continued as long as the values of these factors were increased to the limit of our equipment, (Fig. 10).

There appeared to be a close relationship between circulation pressure and drilling rate in hard, wet, competent formation. Penetration rate was reduced at Imperial Scalp Creek when air velocity became insufficient to effectively clean hole at the bit. This reduction in air velocity was due to buildup of pressure in the annulus caused by slug flow or water influx.

There was no change in penetration rate when the system air lifting 500 bbl. of water per hour from 3,500 ft. was changed to mud. Bore-hole pressure and fluid velocity across the bit in each system apparently offset each other in their effect on drilling rate.

Fishing . . . A fishing job utilizing a knuckle joint, overshot, and jars in washed-out hole was performed without difficulty.

Crooked hole . . . Hole did not deviate any more with air circulation



INCREASE IN AIR CIRCULATION increased penetration rate. Test was made in Joffre area. Fig. 10.

than with mud circulation. The same penetration rate was maintained with air using 50 per cent of the weight required with mud in crooked-hole country.

Caliper logs . . . Caliper logs showed that in formations ranging from soft shale to dense limestone, there was no more hole enlargement with air than with mud circulation.

Formation evaluation . . . Air drilling cuttings from dry sand or shale sections have been completely satisfactory to the geologist. Returns were almost instantaneous and all of the clays were recovered, which is not the case with drilling mud. Color changes in the blow line were often used to log formations.

Sand and shale cuttings from wet, soft-to-medium-hard formation were also satisfactory. Cutting recovery from wet, hard shale or limestone was not as good.

The results from one well which was drilled in competent formation indicated that 28 per cent of the cuttings were good, 27 per cent fair, 30 per cent dust, and 15 per cent no samples.

Attempts were made to improve cutting size and maintain steady flow returns. Table speed and bit weight were varied with no success. Foam-water injection rate and concentration were changed. This improved returns but not particle size. There was no correlation of sample returns with porosity, formation, penetration rate, or other factors.

Conventional and diamond cores have been cut with good recovery in both wet and dry hole where the formation was competent. Drill-stem tests have been run to check formation content.

Exploratory drilling . . . Air drilling appears to have limited application on rank wildcat locations. If high-pressure oil or gas zones are encountered, it must be possible at any time to circulate mud. This could be difficult if porous or fractured potential lost-circulation zones have already been drilled. Exploratory drilling depends on continuous sample returns. The technique of obtaining these samples must be improved.

Equipment . . . Equipment other than the compressors performed satisfactorily. Seventeen per cent down time was recorded against the compressors during 9 months of air-drilling operations.

Rotating-head stripper-rubber consumption was reduced when using a hexagonal kelly. Water condensation at first was a problem when measuring air circulation. This was solved by installing traps and using a Barton dry-flow bellows-type meter.

Conclusion

Air drilling has application in western Canada but more work is required to define suitable areas. Competent formation producing water at high influx rates can be drilled with the simultaneous injection of water and foam. Serious cases of lost circulation may be overcome by using air. The development of an economic method of water shut-off will extend these applications.

There does not appear to be a continuous, dry, medium-to-soft shale section that can be economically drilled with air. It has not been possible to air drill this type of formation under wet conditions.

Penetration rate and bit life may be improved 1½ times when drilling dry formation.

Single-acting trunk piston-type compressors are not satisfactory for air drilling.

Acknowledgment

The authors wish to thank Imperial Oil for permission to publish this report. In particular they would like to express their appreciation to all members of Imperial's western regional producing department who participated in this investigation and who rendered invaluable help to promote its progress.

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2. Bobo, R. A., Ormsby, G. S., Hoch, R. S., "Phillips' Tests Air-Mud Drilling," The Oil and Gas Journal, pp. 82-87, January 24, 1955, and pp. 104-108, February 7, 1955.

A.P.I. Research Project 45 Gets a New Chairman

THE American Petroleum Institute Research Project 45 (APIRP-45), on the "Synthesis, Purification and Properties of Hydrocarbons of Low Molecular Weight," will complete its nineteenth year of operation under the direction of Prof. Cecil E. Boord at Ohio State University, on June 30, 1957. The accompanying picture was taken at a recent meeting of the project's advisory committee, at which time Dr. E. C. Hughes (Standard Oil Co. of Ohio) officially accepted the chairmanship of that committee from Dr. Wheeler G. Lovell (Ethyl Corp.), the retiring chairman.

APIRP-45 is now embarking on a study which it hopes will establish the fundamental principles and means for predicting the knocking behavior of mixtures of pure hydrocarbons. Interaction in such mixtures causes their knock ratings to vary substantially from those which would be predicted by assuming a linear relationship among the components. This will be investigated.

ADVISORY COMMITTEE MEETING FOR A.P.I. RESEARCH PROJECT 45 . . . Back row: E. J. Y. Scott (Socony), Louis Schmerling (U.O.P.), J. M. Derfer (Ohio State), K. W. Greenlee (Ohio State), C. E. Boord (Ohio State), E. C. Hughes (Sohio), W. G. Lovell (Ethyl), L. C. Beard, Jr. (Socony), G. H. Denison (Cal Research), R. A. Randall (G. M.).

Front: L. L. Stout (Ohio State), E. O. Mattocks (A.P.I.), S. S. Shaffer (Humble), F. E. Frey (Phillips), N. D. Coggeshall (Gulf).

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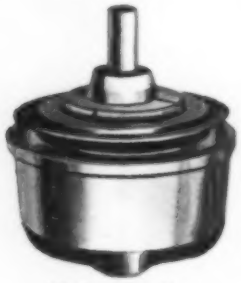
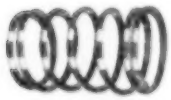
Mission Super-Chrome
Piston Rods



Mission Silver Tap
Slush Pump Valves

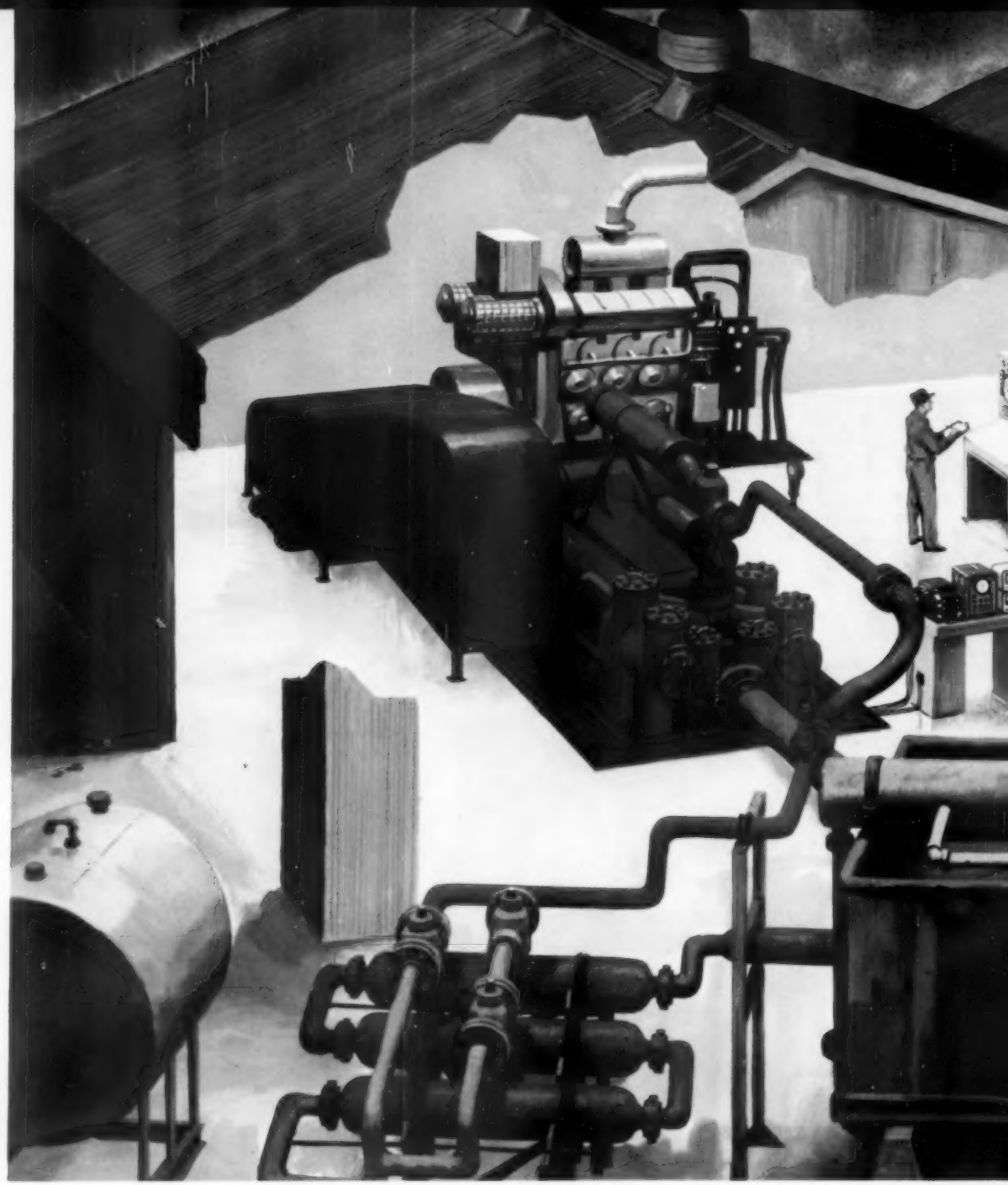
Mission Super-Service®
Slush Pump Valves

Mission Fluid End Pistons



Mission Slush Pump
Valve Springs

Mission Self-Sealing
Gland Packings



Only Mission Has a Fully Instrumen

No other pump parts manufacturer has such an advanced setup. These test pumps at the Mission main plant are fitted with the latest in electronic test instruments including a fourteen channel recording oscillograph described on the reverse side of this adverti
men conduct tests using a v
laden muds at temperatures
sures that often exceed 2,00

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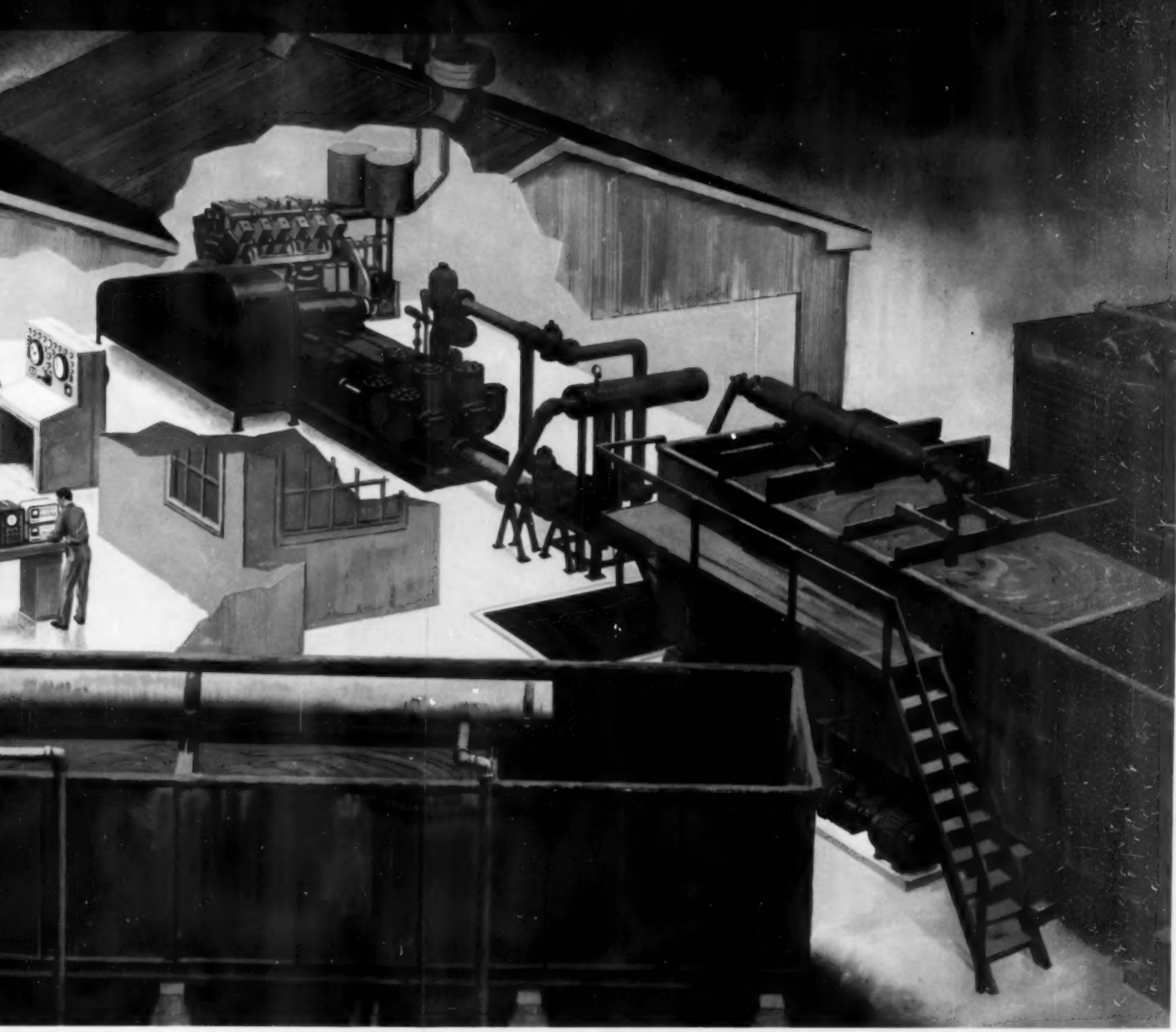
Slush Pump Valves • Valve Springs • Valve Seat Pullers • Pistons • Piston Rods



Test Pump News From Mission

ented Test Pump "Laboratory" Like This

ertisement. Here, Mission research g a variety of contaminated or sand ures that average 155° F. and pres- 2,000 psi. Without these test pump facilities, it would have been impossible to have developed such products as the Mud Monarch Valve whose superiority has been proved in hundreds of field installations.

Nothing but the finest will bear the name of MISSION MANUFACTURING CO.

0 Rockefeller Plaza, New York In The United Kingdom: MISSION MANUFACTURING CO., LTD. • 17 Hanover Square • London, W. I. England • Cable Address—"Missoman"

Rods • Liners • Gland Packings • Slips • Swabs • Centrifugal Pumps • Plug Valves

Mission Installs Electronic Inst

Mission Engineers are using advanced instrumentation techniques to dis

these facts, they will be able to make tomorrow's pump parts even bette

The electronic test pump instrumentation described on these pages is the latest step in a research program which began with the installation of the first Mission test pump nearly twenty years ago. This program has already resulted in many important improvements in pump parts and it is expected that even more important improvements will result from the current phase of a continuing program.

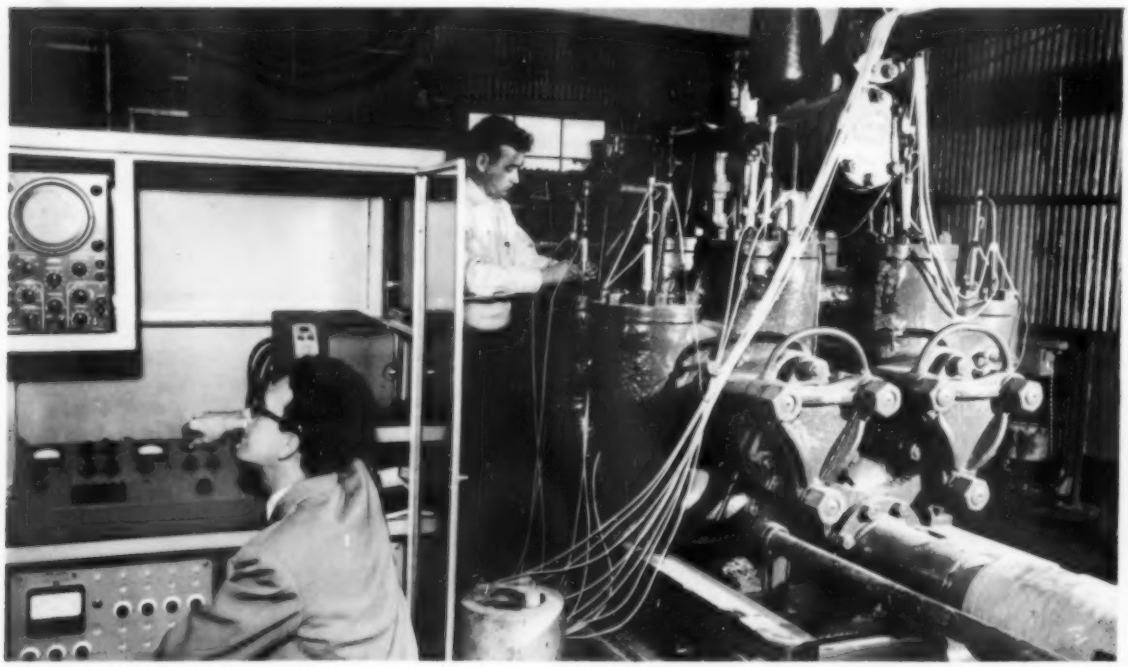
The electronic instrumentation consists of a fourteen channel recording oscillograph fed by a number of appropriate pickups mounted at strategic locations on the fluid end of any of the test slush pumps operated by Mission. In many respects, this instrumentation is similar to the Electrocardiograph that doctors use to study the action of the human heart.

This comparison is especially appropriate since the slush pump is literally the heart of a drilling rig.

Mission Engineers have discovered some hitherto unknown facts about the action of pump parts. An understanding of these facts is making possible important improvements in pump parts design.

In addition to the study of pump parts action by means of the oscillograph, Mission is continuing the program of 24 hour-a-day

Signals from the various pickups on the pump are fed to the amplifiers in the instrument cabinet shown on the left foreground.



strumentation on Test Pumps

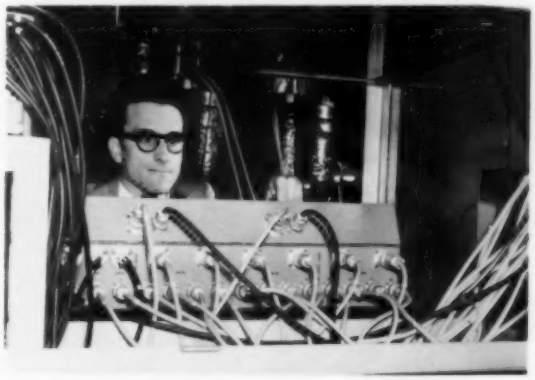
discover hitherto unknown facts about pump parts performance. With better than the outstanding products being produced by Mission today.

endurance testing. A variety of contaminated or sand-laden muds from actual drilling locations are used for these tests. Mud properties are rigidly controlled to simulate any field conditions encountered. Discharge pressures often exceed 2000 psi.

With these complete research and testing facilities, Mission Engineers are making improvements in pump parts that would not be possible otherwise. Tests that definitely confirm the superiority of Mission products put real meaning in the slogan "Nothing but the finest will bear the name of Mission."

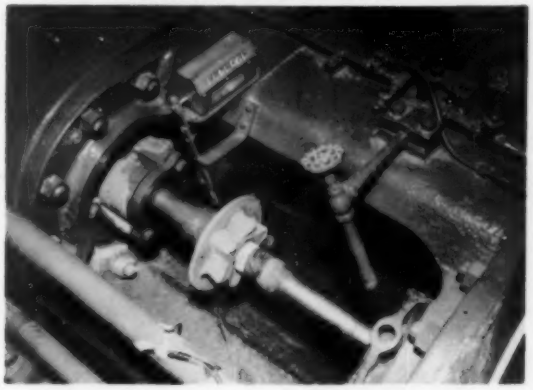
This instrument cabinet contains the fourteen channel recording oscillograph (center right) with channel amplifiers and a cathode ray oscilloscope. A Mission Research Engineer is making notes regarding the calibration of one of the channels.

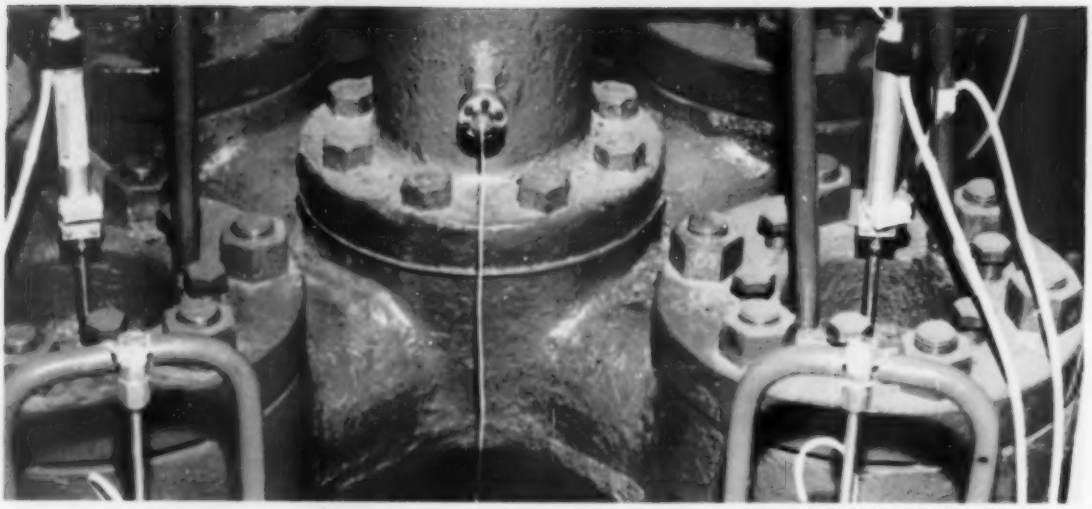
A Mission Research Engineer is shown adjusting the circuit of one of the pick-ups. There is a separate circuit and amplifier channel for each pickup.



A valve lift pickup, like the one shown here, is mounted on each pot cover. These pickups transmit signals that are recorded as valve motion and timing. From this information, Mission Research Engineers can detect the slightest change of valve position.

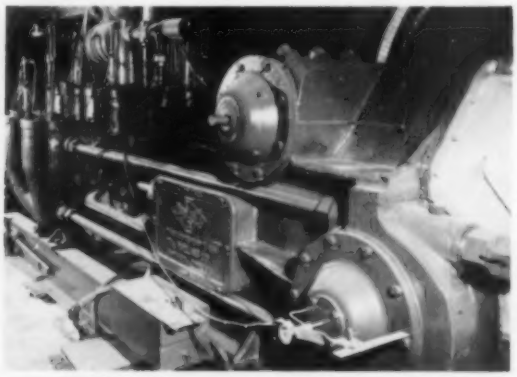
Strain gages are mounted on each rod near the crosshead end to indicate the load on the rod at all times.



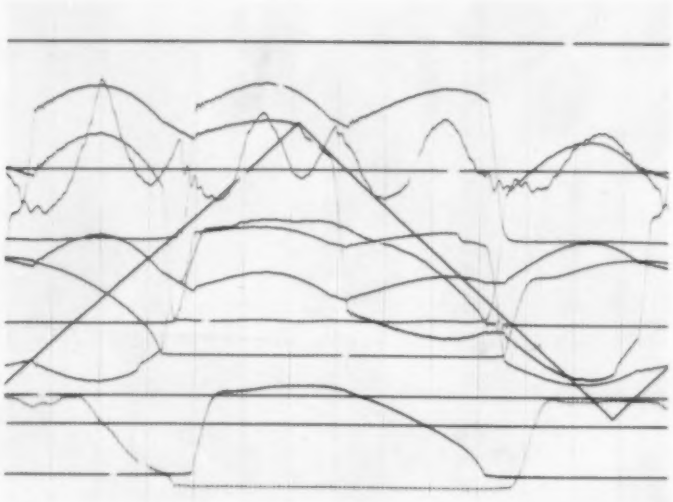


Notice the pressure pickup mounted on the side of the discharge manifold. From this trace, it is possible to determine the relationship between discharge pressure and the operating parts of the pump.

Pressure pickups, like the one shown here, are mounted on the end of each cylinder. These units, plus similar pick-ups on suction and discharge manifolds, give Mission Engineers complete information on instantaneous pressures at all times.



This linear potentiometer mounted on the end of the crankshaft transmits a signal that gives the position of the crank at all times. From this trace, Mission engineers can determine the exact position of the piston at any instant.



This trace from the oscillograph gives Mission Research Engineers detailed information on the action of all Mission fluid-end parts under actual operating conditions. From such traces, valuable new facts concerning pump parts and pump operation are being obtained. These facts are making possible the development of even better pump parts.

HIGHER OCTANES . . .

. . . from an additional 5 per cent of crude oil

That's the claim for a new catalyst for isomerization of pentane and hexane

By Henry G. McGrath

THE UNITED STATES is now consuming nearly 3,700,000 bbl. of automotive gasoline per day. At the present time 30-35 per cent of the gasoline sold is premium or so-called superpremium. Today the country-wide average octane of premium gasoline is 97.5 and of regular, 90.5 research (C.F.R.R.). Several refiners are already marketing superpremium fuels of better than 100 octane. In certain instances the fuel is understood to rate 102. One refiner who introduced a superpremium gasoline last year reported that before the end of the year his superpremium sales amounted to 10-15 per cent of his total domestic gasoline sales.

Catalytic reforming and **alkylation** are being used for gasoline quality improvement. Over 1,000,000 bbl. daily of naphtha is catalytically reformed in the United States. The production of alkylate is currently more than 250,000 bbl. per day and is still used largely in aviation gasoline. Within the next few years, it will, however, be in widespread use in the synthesis of premium gasoline.

Isomerization, like alkylation, is another process for synthesizing isoparaffins. By passing a straight-chain paraffin, e.g., normal butane, over the catalyst, it was possible to convert this plentiful hydrocarbon to isobutane. By the same mechanism normal pentane can be isomerized to the more valuable isopentane or methylbutane. This process was first used in World War II to produce both by direct and indirect means components for high-octane aviation gasoline. In Table 1 the clear and leaded octanes of normal pentane, isopentane, normal hexane, methyl pentanes, and dimethyl butanes are shown. By isomerization of normal hexane it is possible to produce methyl pentanes and dimethyl butanes.

Author is with M. W. Kellogg Co. From paper presented at joint meeting of local sections of American Institute of Chemical Engineers and American Chemical Society, in Beaumont, Tex.

TABLE 1—OCTANE NUMBERS OF PENTANES AND HEXANES

	Research octane numbers	
	Clear	+ 3 cc. TEL
n-Pentane	62	89
i-Pentane	92	106
n-Hexane	25	65
2-Methyl pentane	73	93
3-Methyl pentane	75	93
2,2-Dimethyl butane	92	106
2,3-Dimethyl butane	104	115

Isomerization—Background

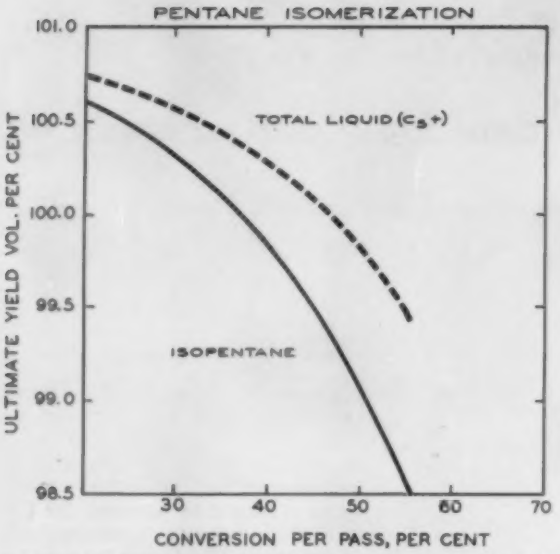
In the 1930's processes were developed by Shell, B. P., Ltd. (formerly Anglo-Iranian), Esso Research & Engineering (formerly Standard Oil Development), U.O.P., and Indiana-Texas. In all cases one of the catalyst ingredients was aluminum chloride. Operations were conducted at temperatures in the range of 180° to 300° F. and at pressure on the order of 200-400 psi. In some cases the reaction was conducted in the liquid phase and in other cases it was vapor phase. Until a few years ago the only process available for the isomerization of light naphtha was the Isomate process which is owned by Standard Oil Co. (Indiana). It was commercialized during World War II with the installation of two plants for the isomerization of a pentane-hexane mixture. In this process a catalyst containing aluminum chloride in an atmosphere of hydrogen chloride and hydrogen was employed at a pressure of 700-800 psi. and a temperature of about 250° F.

Today a number of processes are being offered for conversion of normal pentane and normal hexane to high octane isomers. These processes are offered by Indiana Standard, Pure Oil Co., Atlantic Refining Co., U.O.P., and M. W. Kellogg. None of them is in commercial operation at the present time.

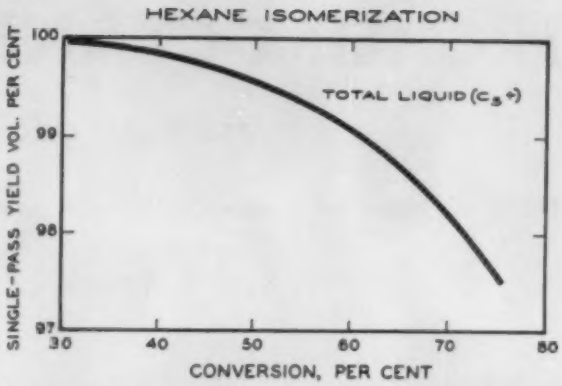
The Gasoline of the Future

In looking over the probable future components of premium and superpremium gasolines, one blend that should perform well on the road both at low and high speeds would have a front end comprising butane, isopentane, and isohexanes. The middle and back end could be principally isoparaffins and aromatics. Three catalytic processes—available to the refiner today—for the synthesis of such a gasoline are isomerization, alkylation, and catalytic reforming.

"The problem of finding an economical method of upgrading this pentane-hexane fraction has been the subject of research for years. Of all the processing techniques available, one that seemed to show the greatest promise...was isomerization."



ULTIMATE YIELD FOR PENTANE isomerization as function of conversion per pass. Yield of total liquid of 100 per cent is obtained at 55 per cent conversion of pentane per pass. Fig. 1.



NORMAL HEXANE isomerization yield, as function of conversion. Yield of total liquid (pentane and heavier) is 98.3 volume per cent at 70 per cent normal hexane conversion on once-through basis. Fig. 2.

Fuel sensitivity . . . It is believed that the trend in higher-octane premium gasoline is leaning more in the direction of lower fuel sensitivity, which is the difference between the octane numbers determined by the "research" and "motor" methods. Fuel sensitivity is becoming more important as the trend continues toward automatic transmissions of the torque-converter type. These engines prevent engine loading at low speeds, shifting the maximum requirement of octanes from low to high speeds. Olefins and aromatics are more sensitive to widely varying engine conditions than isoparaffins. Fuel sensitivity with isoparaffins such as alkylate and pentane-hexane isomers is ordinarily negligible. Thus fuels with substantial amounts of this kind of material can be expected to perform equally well at low and high power outputs.

Natural Gasoline as a Component

Natural gasoline and light naphtha used to be premium-gasoline components. They are fast getting to the point where they cannot be used in gasoline at all. The pentane-hexane fraction in light naphtha probably averages approximately 5 volume per cent based on crude oil. Until recently it has required little or no processing. But this could not be expected to continue with octanes going up every year. Consequently, techniques for upgrading natural gasoline and light naphtha were studied.

Upgrading pentane-hexane . . . The problem of finding an economical method of upgrading this pentane-hexane fraction has been the subject of research and development for several years. Of all the processing techniques available, one that seemed to show the greatest promise for the domestic picture was isomerization. An advantage of isomerization, known for many years, lies in the very high yields of product based on charged stock. But naphtha isomerization units that were built many years ago were subject to extensive mechanical difficulties and corrosion. Plants to upgrade light naphtha and natural gasoline were likewise expensive.

New catalyst . . . On work by M. W. Kellogg Co. a series of catalysts was investigated. A precious-metal catalyst was developed which—although not platinum—is nevertheless an expensive catalyst as far as first cost is concerned.

Vapor-Phase Process

The process that was ultimately developed is a vapor-phase operation under hydrogen pressure, and requires but one reactor. There are no corrosive elements in the system and operating conditions are far less severe than those for catalytic reforming of heavy naphtha. Because of the superior activity and selectivity of the new catalyst, a pentane-hexane feed can be isomerized simultaneously with no harmful interaction. Each stock appears to contribute to the isomer production in the same manner as when separately processed.

Since hexanes isomerize more easily than pentanes, normal pentane is isomerized to about 65 per cent conversion per pass while the normal hexane is being isomerized to the extent of about 75 per cent conversion per pass.

Catalyst advantages . . . There are three features which are outstanding in connection with the catalyst which we have developed: (1) It is more selective than any material that has been reported to date; (2) the quantity of catalyst required for a given conversion is small, and (3) it is believed to operate at a lower temperature than any of the recently announced vapor-phase isomerization processes.

Hydrogen recycle . . . As in the case of many other petroleum catalytic operations that have been developed in the last 20 years, it was found desirable to operate more satisfactorily in a hydrogen atmosphere. In other words, for high catalyst efficiency and selectivity the process is operated at a controlled recycle hydrogen rate. The effect of pressure on conversion is very slight. Lower temperatures were found to increase selectivity and therefore to increase the ultimate yields of the desired products.

The first problem to be solved was the conversion of normal pentane to isopentane. A new catalyst was developed for this reaction. Subsequently, the problem of normal hexane and the other naturally occurring C_6 paraffins were studied. At normal operating temperatures the conversion of normal hexane is approximately 75 per cent per pass. The equilibrium for higher-octane components in the product is more favorable as temperature is reduced.

The operation has been piloted for a considerable period of time. Process studies have been completed on a number of naphthas including Mid-Continent, West Texas, and Kuwait.

Pentane isomerization . . . Fig. 1 shows the ultimate yield for pentane isomerization as a function of conversion per pass. At 55 per cent conversion of pentane per pass the yield of total liquid is a little above 100 per cent. The yield of isopentane is 99.5 vol. per cent. The yield of gas—methane through butane—is approximately 0.6 wt. per cent.

Hexane isomerization . . . In Fig. 2 the yield for normal hexane isomerization is shown as a function of conversion. At 70 per cent normal hexane conversion (once-through basis) the yield of total liquid—pentane and heavier—is 98.3 vol. per cent. The weight per cent yield of gas—methane through butane—is about 2 wt. per cent. Consequently, it is apparent that the catalytic operation is very selective.

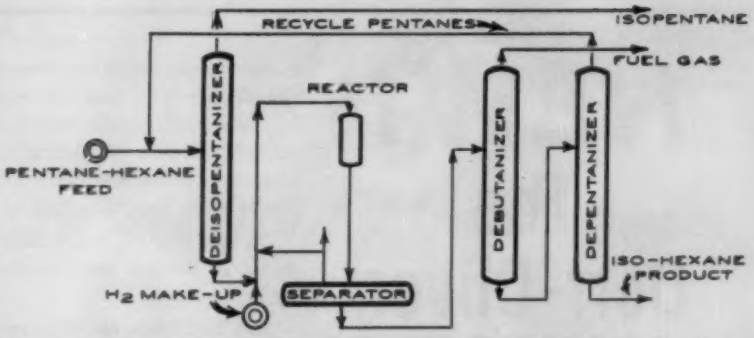
Light Naphtha Processing

A number of different processing techniques could be employed with a light naphtha. If the **pentane cut** were to be isomerized by itself, the processing sequence would involve deisopentanization and isomerization of the normal pentane with the reactor effluent being recycled to the deisopentanizer. If the **hexane cut** were to be processed alone, a similar technique to that just described for n-pentane could be employed. If a **pentane-hexane cut** were to be processed simultaneously, it would be possible to recycle unconverted n-pentane after fractionation and run either single pass or with recycling of the n-hexane.

Pentane-Hexane Feed

A block and line flow diagram for a desulfurized pentane-hexane feed is shown in Fig. 3. A common deisopentanizer receives both the fresh feed and a pentane recycle stream. Bottoms from the deisopentanizer may be fed directly to the catalytic conversion reactor. The hydrogen recycle gas stream likewise enters the catalyst zone under superatmospheric pressure. The function of the hydrogen is to keep the catalyst clean and in a highly active state. Very little hydrogen is consumed in the process, although a small amount of hydrogen must be continuously added to the system.

Fractionation . . . The reactor effluent enters a series of fractionating columns before entering product storage or being recycled for further conversion. A variation on this scheme would involve fractionation of both the isopentane and isohexanes from the feed and reactor effluent streams. When operating with a feed having a relatively high concentration of isohexanes, it is desirable to have a deisohexanizer in the unit. This technique is essentially n-hexane recycling to extinction.



TYPICAL ISOMERIZATION PROCESS, using a desulfurized pentane-hexane feed. A variation of this scheme would involve fractionation of both isopentane and isohexanes from the feed and reactor effluent streams. Fig. 3.

TABLE 2—PENTANE-HEXANE FRACTION FROM NATURAL GASOLINE

	Feed	Product
Total C_5 and C_6:		
Vol. per cent	100	99
Oct. No., + 3 cc. TEL	88	99.6
Isopentane fraction:		
Vol. per cent of total	45	45
Oct. No., + 3 cc. TEL	96	104
Isohexane fraction:		
Vol. per cent of total	55	54
Oct. No., + 3 cc. TEL	82	93.5

TABLE 3—COMPONENT ANALYSIS, PENTANE-HEXANE
(Component, volume per cent)

	Fresh naphtha feed	Total product
i-Pentane	20	51
n-Pentane	32.4	2.4
Cyclopentane	2.1	2.1
2,2-Dimethyl butane	0.7	3.2
2,3-Dimethyl butane	...	2.3
2-Methyl pentane	10.6	13.2
3-Methyl pentane	7.9	9.4
n-Hexane	19.4	9.6
Methylcyclopentane	5.8	6.1
Cyclohexane	1.1	0.7
Relative volume	100	98.9

TABLE 4—ECONOMICS, PENTANE-HEXANE CUT FROM KUWAIT CRUDE

Stock ..... Kuwait pentanes and hexanes

Feed stream—	n-Pentane	Mixed pentanes and hexanes		
Hexanes, vol. per cent	7	55		
Capacity, bbl./day	3,500	3,100		
		A	B	
Product, Oct. No.:				
Clear	90.9	79	79.8	
+ 3 cc. TEL	102.2	96	96.7	
Process investment (thousand)	$1,475	$1,100	$1,425	
Payout, years	1.0	1.4	1.8	
Direct operating cost (cents per bbl.)	21	16	22	
Cost (cents per research octane number barrel)*	9.6	7.6	8.4	

A—Pentane recycle, single pass on hexane. B—Including deisohexanizer.
*Based on 93 research octane number with 3 cc. TEL pool gasoline.

From natural gasoline . . . In Table 2 results are shown for a pentane-hexane fraction from natural gasoline. The processing scheme involved recycle on the pentane and single-pass on the hexanes. Examination of the "product" column in Table 2 reveals that the total product rated 99.6 octane (C.F.R.R. + 3 cc. TEL), the isopentane portion 104 octane, and the isohexane portion 93.5 octane.

In Table 3 a componential analysis of a pentane-hexane cut is shown following isomerization. The processing technique is the same as that described above, i.e., recycling unconverted n-pentane but single pass on the hexanes.

Costs . . . In Table 4 plant costs are shown for different operations on a pentane and a pentane-hexane cut from Kuwait crude oil. If a refiner has 3,100 bbl. per day of this pentane-hexane mixture, an isomerization plant using pentane recycle but only single-pass on the hexanes has been estimated to cost $1,100,000. Direct operating costs are about 16 cents per barrel and the payout on the process unit has been calculated at 1.4 years. The payout is before federal income tax, depreciation, and interest on money. A pentane isomerization unit to handle 3,500 bbl. per day would cost $1,475,000 and show a payout of 1.0 year. The octane of the product with TEL is 102 for the pentane isomerization and 96 for the pentane-hexane operation.

NEW!

The Dorr-Oliver CLAYJECTOR for Controlling Weighted Muds

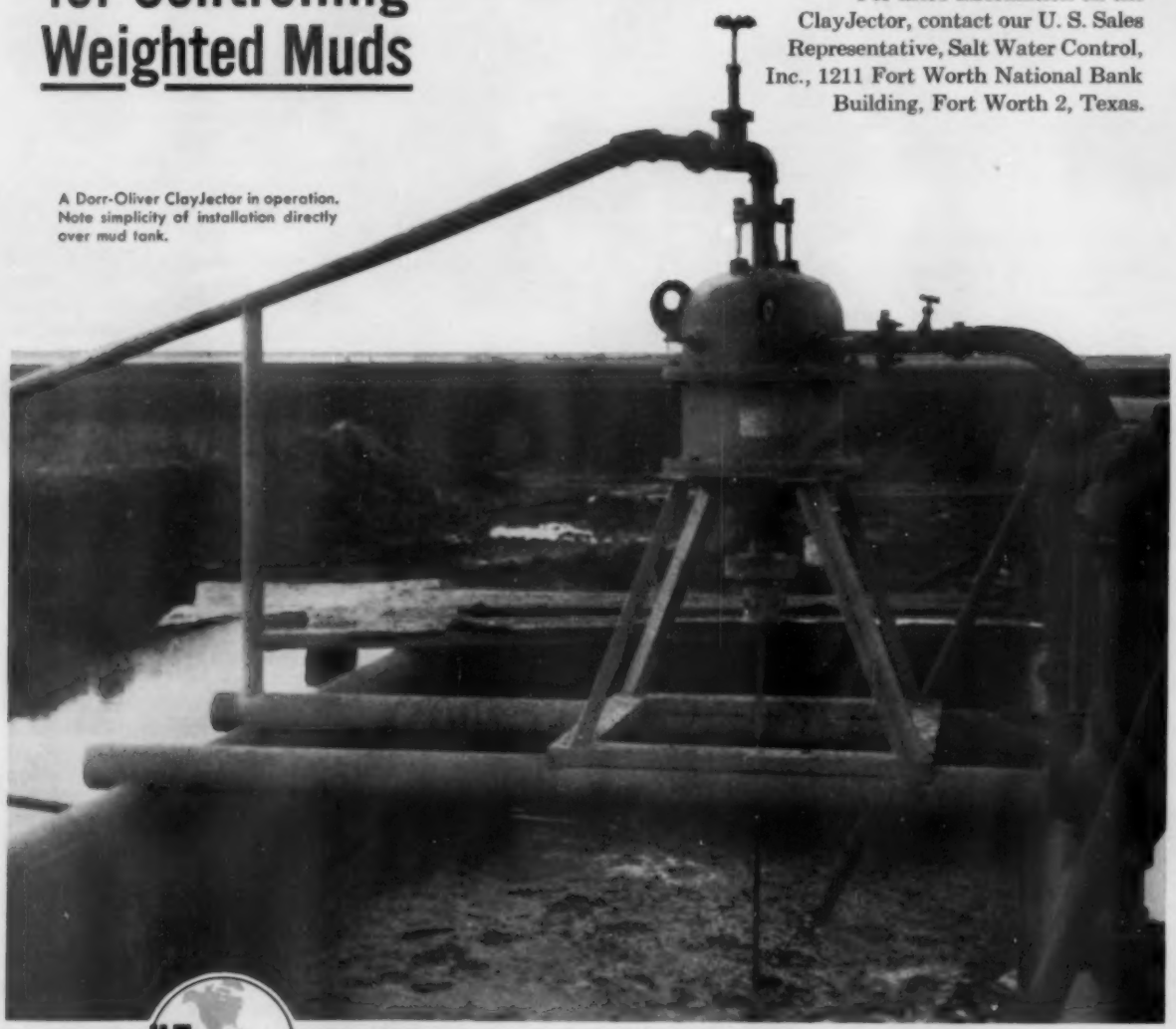
Latest development in controlling drill mud weights is the Dorr-Oliver ClayJector. This new unit is designed specifically for weighted muds . . . will mechanically reject undesirable drilled solids and retain the valuable barites (weighting materials) in the system. Optimum solids content is maintained at a minimum cost for barites which would be lost if solids are controlled by dilution and jetting tanks.

On one recent rig installation where a ClayJector was installed to maintain a 17 lbs./gal. mud system, the conservative estimate of savings was $425 per day!

Key to ClayJector efficiency is the DorrClone classifier, a cylinder-conical unit using centrifugal force in place of gravity. Four of these units are manifolded in a common housing with a common feed, overflow, and underflow. Any of the units can be cut out of service without opening the housing to meet variations in circulation requirements.

For more information on the ClayJector, contact our U. S. Sales Representative, Salt Water Control, Inc., 1211 Fort Worth National Bank Building, Fort Worth 2, Texas.

A Dorr-Oliver ClayJector in operation. Note simplicity of installation directly over mud tank.



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STAMFORD • CONNECTICUT • U.S.A.

By W. L. Nelson
Technical Editor

COST-imating

32. Refinery Processing Since 1920, And Cost of Refineries

	Barrels per 100 bbl. of crude-oil capacity									
	1920		1930		1946		1950		1956	
	Avg.	L.O.	Avg.	L.O.	Avg.	L.O.	Avg.	L.O.	Avg.	L.O.
Average refinery capacity, bbl. per day	4,100	....	10,000	....	14,000	....	19,500	....	28,000	....
Distillation:										
Batch shell stills*	40	40	....	....	....	....	....	....	....	....
Continuous shell stills	80	80	80	75	....	....	....	....	....	....
Pipestill topping	....	....	20	25	100	100	100	100	100	100
Desalting or a settling still	80	80	100	100	100	100	100	100	100	100
Vacuum distillation	....	....	0.5	....	9.2	5.9	11.3	7.6	23.7	19.4
Thermal:										
Cracking	13.1	18.8	37.0	40.7	32.9	33.9	25.5	26.2	18.5	18.9
Reforming	....	....	2.0	2.1	5.6	5.8	4.5	4.6	3.5	3.6
Coking	....	....	3.0	3.1	1.8	1.9	2.4	2.5	3.4	3.5
Visbreaking	....	....	....	....	2.0	3.7	2.4	4.1	4.0	5.3
Catalytic:										
Cracking	....	....	....	....	19.1	19.5	26.5	28.2	39.0	39.8
Reforming	....	....	....	....	....	....	1.0	1.0	11.1	11.3
Asphalt manufacture	4.7	5.0	3.8	4.0	5.2	5.3	5.6	5.8	6.0	6.1
Polymerization	....	....	....	....	1.4	1.5	1.0	1.1	1.4	1.4
Alkylation	....	....	....	....	1.2	1.2	1.2	1.3	2.8	2.9
Hydrodesulfurization	....	....	....	....	....	....	....	....	5.2	5.3
Acid treating (light oils)	20.0	21.2	15.5	16.1	....	....	....	....	....	....
Acid treating, rerunning	15.0	15.9	15.5	16.1	....	....	....	....	....	....
Sweetening gasoline and TEL plant	26.8	28.4	46.6	48.5	43.2	47.0	47.6	53.5	48.8	51.6
Other light-oil treating	32.7	34.6	25.3	26.3	6.2	6.7	5.8	6.0	4.4	4.6
Storage tanks, bbl.	90	80	80	75	80	70	80	70	80	70
Steam required per barrel	†200	†135	†186	†130	†154	†126	†146	†124	†140	†121
Lube:										
Finished oil	5.7	....	3.7	....	2.7	....	2.6	....	2.1	....
Steam stills	8.0	....	5.0	....	(‡)	....	(‡)	....	(‡)	....
Acid treating	4.6	....	3.0	....	1.2	....	....	....	....	....
Solvent extraction	....	....	....	....	4.8	....	5.2	....	4.2	....
Dewax:										
Presses	1.9	....	1.0	....	0.3	....	....	....	....	....
Centrifuge	§3.2	....	2.5	....	0.4	....	....	....	....	....
Solvent	....	....	....	....	1.5	....	2.2	....	1.8	....
Rerunning	5.3	....	3.7	....	5.4	....	5.0	....	4.0	....
Decolorizing	5.7	....	3.7	....	2.7	....	2.6	....	2.1	....
Cost of offsite facilities, per cent	44	38	42	36	45	45	48	48	40	40
Cost of refinery, dollars per bbl., at date	$354	$264	$387	$302	$549	$452	$775	$676	$1,160	$1,010
Cost of refinery, dollars per bbl., 1946 prices	$501	$373	$550	$430	$549	$452	$530	$462	$593	$517

*Mainly rerunning operations. †Pounds steam generated per barrel. ‡Vacuum distillation included above. §Cold settling.

THE CAPACITIES of the process units used in the tabulation on this page were obtained from the product yields at the dates of the operations. Costs were taken from the COST-imating series, especially Nos. 26-30 (March 11 through May 13, 1957). However, very old equipment was not presented in these issues and accordingly the following 1946 costs were located in the literature or computed by making simple designs—all dollars per daily barrel—shell stills, $134; steam stills, $147; continuous battery, $89; acid treating (gasoline), $19-$29; doctor treating, batch, $15-$35; and doctor sweetening, continuous, $13-$26. Other costs were published in the second edition of Petroleum Refinery Engineering, McGraw-Hill Book Co., Inc., New York, 1941.

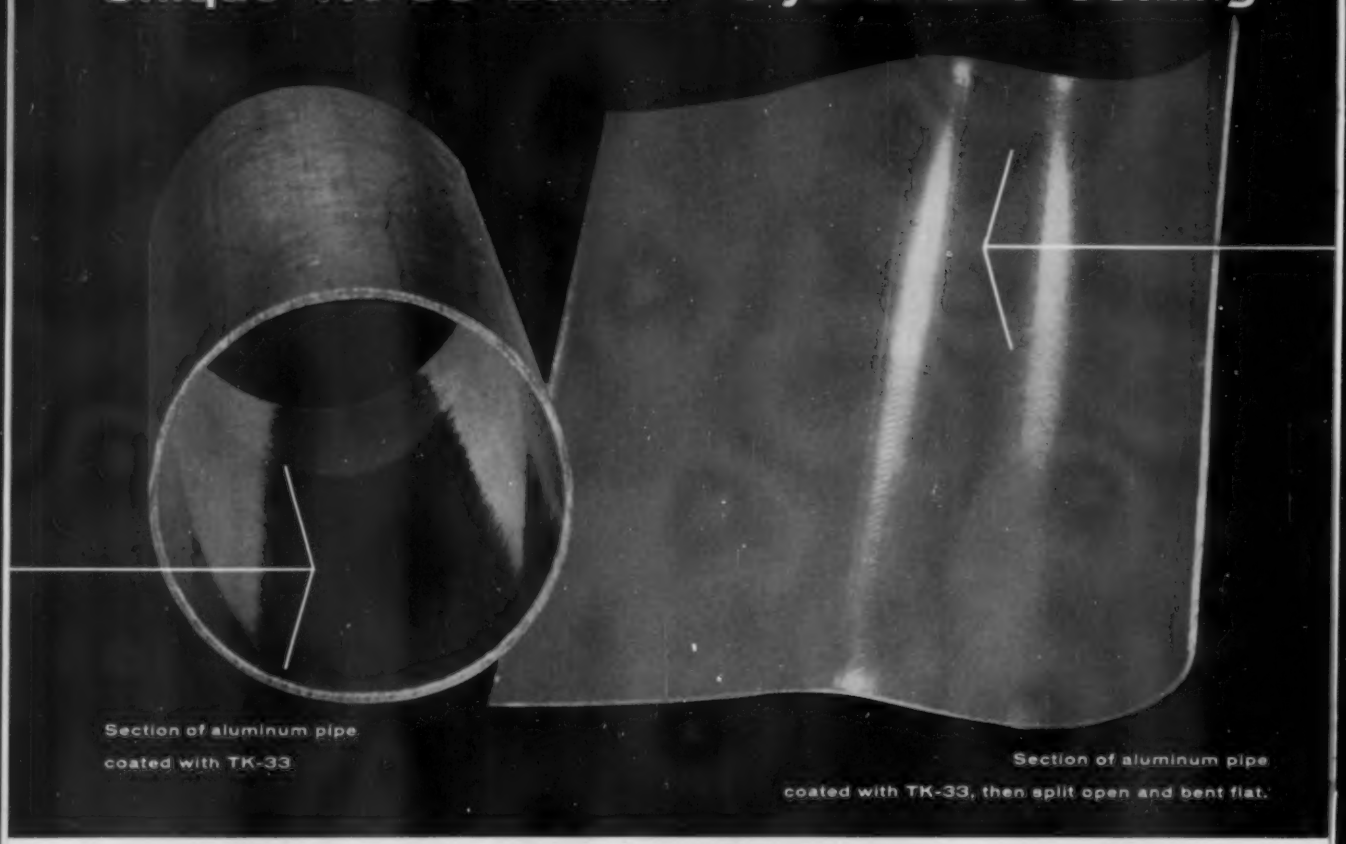
NELSON REFINERY CONSTRUCTION COST INDEX

1920	*70.8
1930	70.3
1935	62.7
1940	77.6
1946	100.0
1950	146.2
1956	195.6

*E.N.R.—Engineering News Record Construction Index.

NEW *from* Tube-Kote

Unique TK-33 Baked Polyurethane Coating



Section of aluminum pipe coated with TK-33

Section of aluminum pipe coated with TK-33, then split open and bent flat.

Won't Crack, Craze, or Chip

EVEN TURNED WRONGSIDE OUT

The flexibility of new TK-33 gives you greater protection against chipping and peeling than any other product. The coating adheres to the metal despite dropping, smashing, or bending. In laboratory tests, a 5 mil coating of TK-33 passes a ⅛ inch mandrel bend. This ability of TK-33 to move with the metal means you are buying more protection with TK-33 than was ever possible before. In a standard G-E Impact-Flexibility Tester, TK-33 coated aluminum pipe passes 20 per cent elongation at 14.8 ft/lbs impact.

With these new high standards in impact and chipping resistance, TK-33 coated pipe also has excellent resistance to acid and caustic fluids. Resistance to abrasion is excellent. New TK-33 is your answer to corrosion problems in pipe for gathering lines, salt water disposal systems, flow lines, and similar uses.

This new product is a unique formulation containing polyurethane. Like all Tube-Kote products, it has been tested and proved.

Write or call for a Tube-Kote representative to demonstrate the amazing flexibility of TK-33. Or we will be happy to send you complete information and a sample coated with TK-33.

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2727 Holmes Road • P. O. Box 20037 • Houston, Texas

By Dr. J. M. Ryan
The Datics Corp.

Using Electronic Computers in the Oil Industry — Part 12

Stored-Program Computations of Gravity Data

GRAVITY DATA is the basic raw material for many calculations of value to the geophysicist. One of these, the residual, is the difference between the gravity at any point and the average gravity of the surrounding points. Another is the second vertical derivative of the gravitational field at each point. The residual may be calculated fairly simply on a desk calculator. Most economical methods of estimating second derivatives necessitate the use of electronic computers of some kind.

Sharpe and Fullerton[1] have described a method of estimating the second derivative using an IBM 604. The purpose of the present issue of PETROdatics is to show how this method may be adapted to stored program machines permitting simultaneous calculation of the residual and several different estimates of the second derivative.

The first step in the Sharpe-Fullerton method is to draw a contour map of the gravitational data. Then a trigonal grid overlay is placed over the contour map and the gravity estimated for each point on the grid. A trigonal grid is one composed of three sets of parallel lines. One set of horizontal, one set intersects the horizontal in a 60° angle, while the final set makes a 120° angle with the horizontal. The figure shows an example of a trigonal-grid overlay on a gravity contour map. Note that for each point the gravity is available at many sets of six equidistant points. If a standard rectangular grid had been used, gravities would have been available only at four equidistant points.

Before proceeding further it will be helpful to adopt a suitable notation. The lines sloping upward to the right and the horizontal lines of the trigonal grid may be used to identify any intersection within the grid. These two sets of lines may be referred to respectively as columns and rows. Columns and rows are numbered sequentially starting from the left and the top. Then the gravity at any point F_{rc} is that found at the intersection of row r and column c. Define the term $\Sigma F_{rc}^{(d)}$ to mean the sum of the gravities at the six points d units from the point (r, c). Using this notation the residual at a point (r, c), R_{rc}, becomes:

$$R_{rc} = F_{rc} - 1/6\,\Sigma F_{rc}^{(1)} \qquad (1)$$

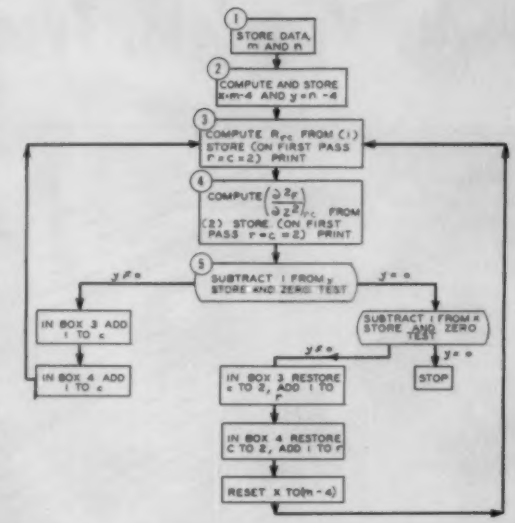
Sharpe and Fullerton have shown that one estimate of the second derivative is of the form:

$$(\delta^2 F/\delta Z^2)_{rc} = A_1 F_{rc} + A_2 \Sigma F_{rc}^{(1)} + \ldots + A_n \Sigma F_{rc}^{(d)} \qquad (2)$$

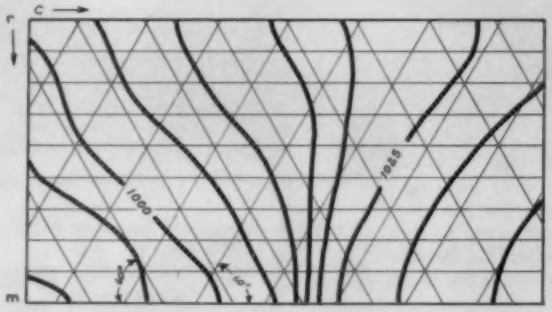
In their paper Sharpe and Fullerton use only the first four terms of Equation 2. It is quite practical to use four different terms or even a larger number of terms. If six or more terms are used it will generally be necessary to determine the A_1 on an electronic computer rather than by using hand methods.

The procedure just described does not permit the calculation of second derivatives around the perimeter of the chart. Maps may be overlapped in order to obtain much of this missing information, however.

In the flow diagram shown the basic procedure for a stored program machine is portrayed. This flow diagram assumes that only the first four terms of Equation 2 are employed. The number of rows is defined as m and the number of columns as n.


1
STORE DATA m AND n
2
COMPUTE AND STORE x=m-4 AND y=n-4
3
COMPUTE R_{rc} FROM (1) STORE (ON FIRST PASS r=c=2) PRINT
4
COMPUTE $\left(\frac{\partial^2 F}{\partial Z^2}\right)_{rc}$ FROM (2) STORE (ON FIRST PASS r=c=2) PRINT
5
SUBTRACT 1 FROM y STORE AND ZERO TEST
y ≠ 0
y = 0
IN BOX 3 ADD 1 TO c
IN BOX 4 ADD 1 TO c
SUBTRACT 1 FROM x STORE AND ZERO TEST
y ≠ 0
y = 0
IN BOX 3 RESTORE c TO 2, ADD 1 TO r
STOP
IN BOX 4 RESTORE C TO 2, ADD 1 TO r
RESET x TO(m-4)

Flow diagram shows basic procedure for a stored-program machine.



Contour map of gravitational data with trigonal-grid overlay.

Reference

1. Sharpe, Joseph A., and Fullerton, Paul N., "An Application of Punched Card Methods in Geophysical Interpretation," Geophysics, October 1952.

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—92

Specific-Gravity Variations, Types of Flow

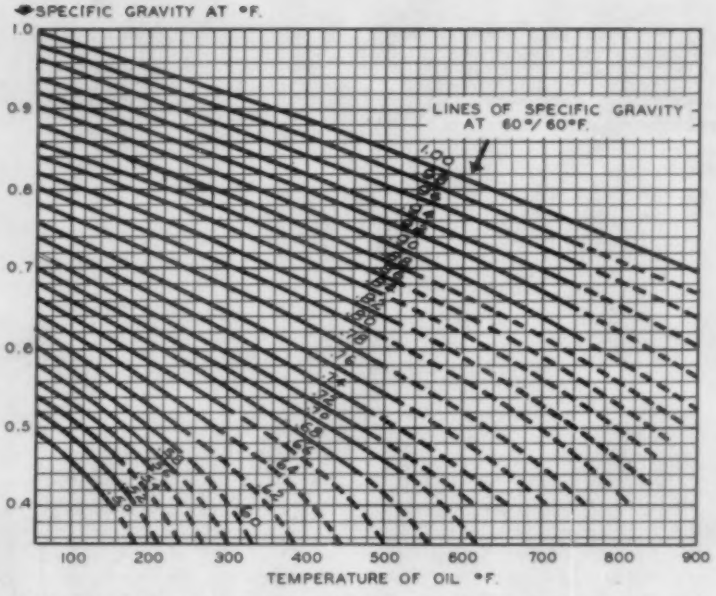
FIG. 2B shows specific-gravity variations. In the movement of fluids there are two kinds of flow: (1) Streamline flow is one in which the fluid flows in smooth layers without mixing of the layers. In other words, as the name implies, the flow is in straight unbroken lines, and (2) turbulent flow is flow in which there are no set stream lines and the fluid is mixed continuously. The entire mass is a mixture of eddies and twists that results in a swirling turbulent flow.

Fig. 3 indicates the two types of flow.

Pipe size . . . Pipe size plays an important part in any pumping operation. For a given throughput the pressure drop increases rapidly with decreasing pipe diameters. For example, at the same pumping rate, the pressure drop through a 3-in. pipe is about 30 times as large as the drop through a 6-in. pipe. You can see from this that while the initial cost would be less for the 3-in. pipe that the pumping cost would be considerably higher. Desirable installations are worked out on the basis of economics.

The following table shows the pressure drop when pumping water through pipes of various sizes:

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso-Standard Oil Co.

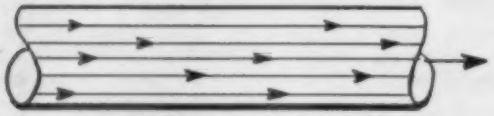


SPECIFIC GRAVITY and temperature relations of petroleum (approximate). Fig. 2b.

TABLE 1—PRESSURE DROP IN PSIG. PER 100 FT.
(When pumping water through smooth pipe)

Rate— (G.P.M.)	Size of pipe 1-in.	2-in.	3-in.	4-in.	6-in.
10	3.16	0.12	...	...	...
25	19.00	0.67	...	...	...
50	...	2.44	0.35	0.07	...
100	...	...	1.31	0.33	0.05
200	...	...	5.02	1.22	0.17
300	...	...	11.20	2.66	0.37
400	...	...	19.50	4.73	0.65

Another factor that affects fluid flow is the degree of roughness of the internal wall of the pipe. Old, rusty, or pitted pipe would offer more resistance to flow and would therefore increase the pressure drop. Fluid flow is also affected not only by the length of pipe but also by the number and type of fittings in the system.



STREAM LINE FLOW

TURBULENT FLOW

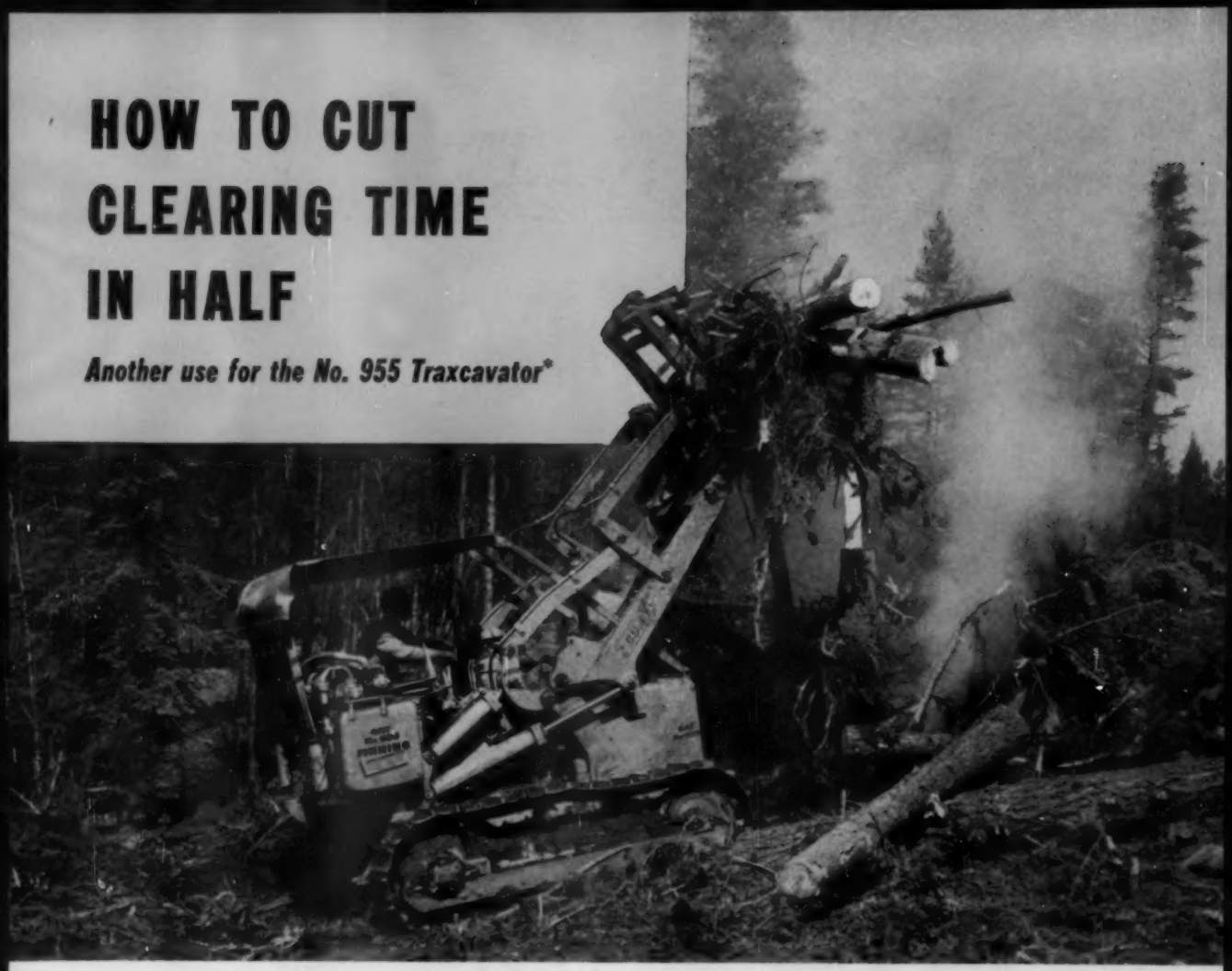
Fig. 3.

STREAM-LINE flow is used where the pressure drop through the system must be kept low and where mixing in the line is not important.

TURBULENT FLOW is important for both blending and heat-transfer operations. A swirling flow means better mixing in the lines and so this type of flow is used in blending operations. Turbulent flow also means better heat-transfer rates and so this type of flow is necessary for most efficient operation of heat-exchanger equipment.

HOW TO CUT CLEARING TIME IN HALF

Another use for the No. 955 Traxcavator*



Conyes Construction Corp., San Pablo, Calif., is using six Caterpillar No. 955 Traxcavators to clear 210 miles of pipeline right-of-way in British Columbia. The company estimates that these Cat-built units *are cutting clearing time in half.* Here's how:

To cut a 60-foot-wide path through jack pine and fir, a D8 knocks down the trees. Everything over eight inches is salvaged by a crew. Then the No. 955s, equipped with alligator jaws operated with a hydraulic ram, pile the logs along the right-of-way and the remaining material on brush fires. The Traxcavators are even used to accelerate the fires. The units lift the top of the pile and use their blower-type engine fans to get a hot fire going quickly.

This method of clearing has enabled Conyes to average one-half to three-quarters of a mile per day in rough going—even working in 10 to 20 inches of snow!

The No. 955 is the newest Caterpillar-built equipment for pipeline spreads. Worked with alligator jaws, general purpose bucket, skeleton rock bucket, or bulldozer blades, this versatile unit enables you to pioneer roads, clear, backfill, build equipment sites and storage yards, and load trucks.

There are three sizes of Caterpillar-built Traxcavators—the No. 933, the No. 955 and the No. 977. They range in size from one-yard to 2¼-yard capacity, and, like all CAT* pipeline equipment, are designed to stay on the job.

Wherever the pipe takes you, you always are near fast, efficient Caterpillar service with factory parts that you can trust. So see your Caterpillar Dealer soon. He'll demonstrate these big, versatile machines on your job . . . at your convenience.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

Sinclair Finds Another New Oil Field

To those who live in a region known as Aguasay, in the State of Monagas, eastern Venezuela, the oil derrick is becoming a familiar sight.

Here, a Sinclair subsidiary – Venezuelan Petroleum Company – recently discovered another significant new field. Subsequent drilling has confirmed the importance of the discovery.

To oil statisticians, these derricks are towering evidence of Sinclair's successful program to increase its crude oil production and reserves – a program that is being carried on in the United States, both onshore and offshore, in Canada, Venezuela and elsewhere.

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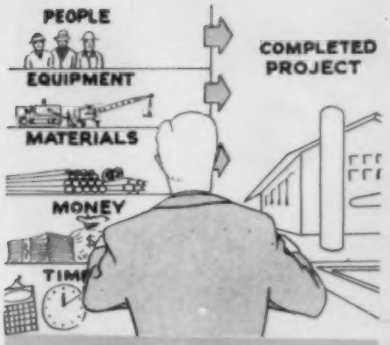
A 10-MINUTE JOURNAL FEATURE

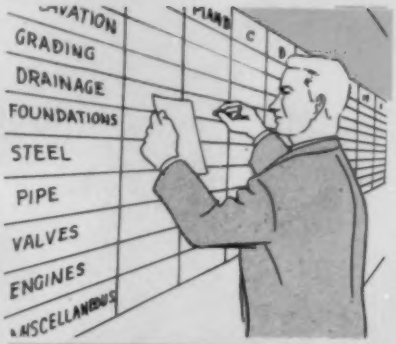
Better Management

PLAN DEVELOPMENT



Analyze factors and goal

Investigate all ideas and plans



Outline, in full, selected plan

THE oil industry with its many varied and complex tasks, continues to demand more and more from the men placed in all levels of supervision.

Basic to managerial ability, as contrasted with technical ability, is the manner in which certain "management tools" are developed and applied. Planning has proved to be an important tool of management function.

In simple terms our management job is to get things done. And, supervisors are selected for their positions because it has been determined that they are capable of understanding the over-all objectives of their company and defined scope of responsibility. Given a knowledge of the factors they have to work with, which includes such things as people, equipment, materials, money, and time, the task is to combine these factors to get the job done in accordance with known objectives.

A planned route is the surest, shortest, and most effective one, and job planning is good management habit. This habit is made easier if a basic pattern is followed. A pattern for planning can and often must be varied; however, value will come **from using question approach.**

First step in plan development is to analyze the factors to be utilized in getting the job done. It is imperative that you have clearly in mind where you want to go and what you have to work with.

Beyond the first step in the creation of a planning technique based on the question approach, other steps should not be considered as disconnected but rather a formula with all parts important and essential.

What must be done? Planning requires thought, judgment, and experience, all of which are called on to define for subordinates a clear understanding of what is to be done. The normally weak link of communications can be avoided here if initial determination of what is to be done is adequately detailed.

Author: Sam Brown, Field Representative, Helmerich & Payne, Inc., Tulsa.

How is the job to be done? These answers should include methods of performance along with the selection of factors to employ and in what proportion. Every individual in the oil industry has seen the application of new and improved methods in every phase of our operations. In fact, operational progress is based on the application of better methods. Outline the method you wish to use, control it, and discard only after a fair and factual trial.

Where should the work be done? This answer is usually dictated by facts beyond immediate control, and relates primarily to that factor of space or physical limits. However, a little thought given to the most effective use of all factors at hand might result in a deviation from normal flow or place of work.

Who should do the work? No other question is so dependent for an answer on a preanalysis of factors to be used in getting the job done, and in particular an analysis of manpower both as individuals and as groups. Every man can be said to have abilities based on a combination of qualities, some of which are physical, mental, moral, experience, and education. Only the most careful, objective, and constant analysis of the people available can result in the effective selection of who should do the job.

Other considerations under this question concern selection of work level, responsibility for results, etc.

When should it be done? Familiar is the oil-field saying, "Do something even if you do it wrong," and a lot of work has been accomplished without benefit of taking time to plan, but this "do it now and plan later" approach has also resulted in needless waste. Timing is important and is the thread that ties our planning pattern into a neat bundle. Also unforeseen things that disrupt timing and a plan of action add to the planner's headaches. However, there are many subscribers to the old adage that "practice makes perfect" and the supervisor that will practice planning by any system of his choice will develop a good management habit.

SOME TIPS O

PLAN INITIATION

Alert those involved in plan

Direct course outlined in plan

Diagnose and correct defects

THE supervisor who has decided to develop and practice good management habits will find use for many management tools and practices. Plan development is a solid practice on which to move toward job objectives. Beyond this point comes the **initiation of the plan.**

The complexity of initiation is in direct proportion to the number of people and other resources involved in carrying out the plan. Some definite steps can be prescribed to aid in the initiation of any developed plan.

Alerting is simply informing all people and other resources or factors of their part in the plan. This includes the organization of the working team and positioning people and other resources in accordance with their known capacities. If adequate thought has been given to answering the questions in plan development the task of alerting and organizing to get the job done is simplified.

Directing is a vital part of a supervisor's job. A mobile piece of machinery, such as an automobile, having been planned and put together has to be directed when driving toward an objective. Similarly a plan, though much more complex in structure, can be considered as a completed unit made up of certain tangible resources that have to be directed to a given objective.

Directing can be best performed when, in the case of a plan, all parties including director and directee have clearly and unmistakenly in mind what is to be done and what the job objective is.

The supervisor must for best results follow the accepted principles of giving directions or orders. Also because giving instruction is in a sense teaching, he should learn and follow the basic principles of good teaching.

Coordination should not be confused with cooperation. There may be willingness to cooperate but a lack of application of important aids to bring about coordination in the successful completion of the job. Useful coordination aids which include job description, routing, scheduling, written procedure, budgets, and organization charts, are essential to coordination and initiation of the plan. Coordination reduces the possibility of overloading certain resources or work sections and tends to create over-all efficiency. Both horizontal and vertical coordination are important, vertical coordination being concerned with integrating the activities of departments or sections.

Control is a process of continual inspection and corrective action based on inspection or observation. Control should not be based on guess work and observation alone. Standards of quality and quantity of work need to be based on and set out on historical facts and records where possible. Of equal importance these standards of expectation for every individual, machine, etc., should be known to all concerned. One of the most glaring weaknesses found in most supervisors is either the unwillingness or inability to let subordinates know what is expected of them.

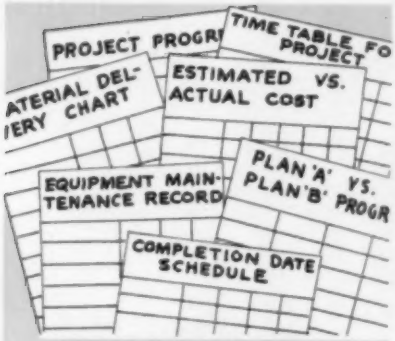
This control function lends itself to the development and application of useful aids which can return valuable and needed information when planning the next job. Strive to obtain factual proof to substantiate everyday guesses as to how much and what quality of work should be turned out by certain people, machines, gangs, etc.

These standards are often a matter of judgment and it is well known that accurate standards of performance cannot always be set down in written form. However, to the extent that a supervisor is able to improve on the accuracy of determining quality and quantity standards of work, to that extent will he be able to develop and initiate a plan, let subordinates know what is expected, and use better judgment in checking actual performance.

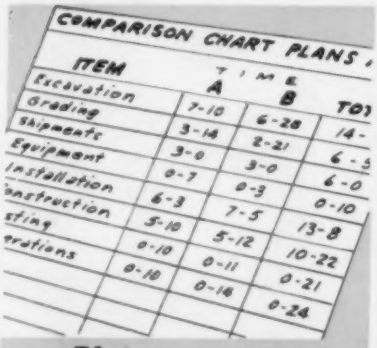
It remains a simple fact that the supervisor's responsibility is to get the job done, day after day. Thoughtful initiation of a work plan through the steps of alerting, directing, coordinating, and controlling will positively result in improved quantity and quality of work and general manner of work performance.

ON PLANNING

PLAN CHARTING



Fit progress chart to purpose



Plot progress of each step

Analyze charted operations

IN **basic plan development** one of the questions to be answered is, How will the job be done? Even with the accepted idea that a company to be progressive must continually improve work methods, too often methods selected are timeworn and outdated.

In a sense a supervisor needs to become better-method minded and develop a system for analyzing the present situation and in turn determine better methods.

This becoming better-method minded in planning calls for a systematic analysis of a work situation and the application of motion-economy principles, and two of the most important techniques of method improvements are process analysis and operation analysis.

A good and very useful management habit in planning is to develop flow process charts for each phase of the work, and the following procedure is suggested:

1. **State in clear, concise terms** the process being studied or planned and be sure that it can be identified from start of the job to the finish. If the process or job phase is broken into its smallest and yet complete segments analysis is made easier. They can be put back together later for complete plan charting.

2. **Subject determination** falls next in line with the need to select in each instance whether the flow chart will follow a form being processed, and item being produced, activities of a specific worker, or activities of a homogeneous group. In using this process-analysis approach it is often useful to chart the plan using various or overlapping subjects. This will aid in over-all timing or coordination of activities.

3. **Limits of each process study must be determined.** It is usually wise to chart by relatively small units or scope of activities. Make a clear written expression of the beginning and end of the process being analyzed.

4. **Each step** in the process should be completely and clearly described. The very action of accurately describing each step will add materially to a better understanding of where improvements can be made. If in describing the steps as they have been performed in the past certain changes appear possible, make note of them.

5. **Assign each step a symbol.** This is another way to spot likely improvements. This allows for graphic presentation of the sequence of work. There are universally used symbols for this purpose and they can be learned and used to advantage. The graphic presentation of each step in the process makes possible the next phase of analysis.

6. **The recording of time taken and distances moved** or covered is of material importance in coordinating overall work plan and setting up comparisons to determine actual savings in the introduction of better methods.

In charting a complete plan of work, judgment of time and distance can be brought more in focus with the actual facts by referring to historical data kept on the various phases of the operation. Because timing is such an important part of planning, continued process analysis and plan charting with recording of times for each phase of the operation, will make future planning and replanning much more effective.

7. **Quantities or degree of accomplishment,** where possible, should be recorded at each step. A constant record of these data is also invaluable in making future comparisons, and measuring method improvement.

8. **Summarization of data** recorded on the process chart is the final step in process analysis. Summary should consist of totaling of time taken and distances traveled as well as notation of weaknesses or possible improvements in present operations.

With the planned or present method charted, each step in the work process should be analyzed to determine if certain activities might be improved, or in some instances eliminated entirely.

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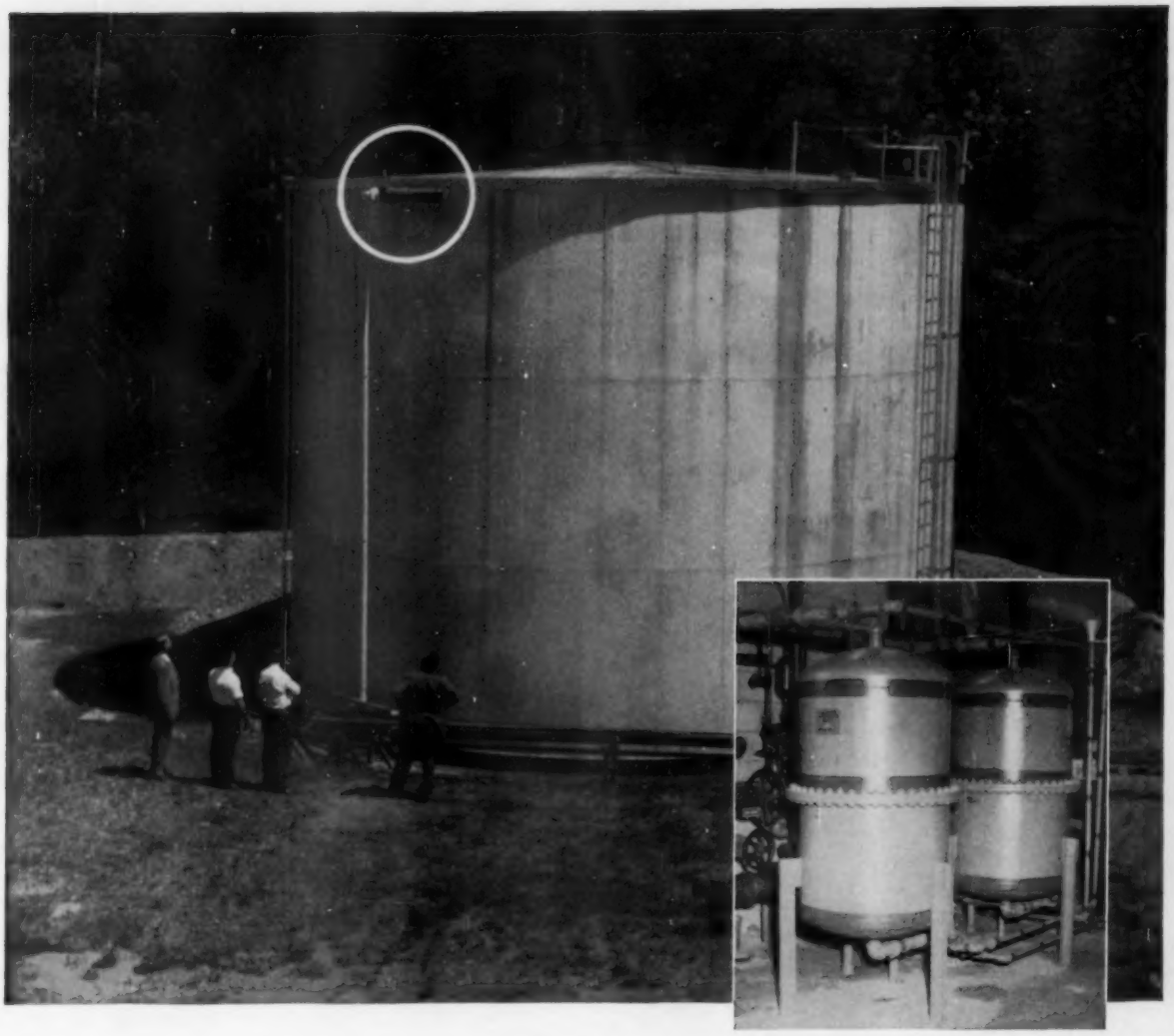

A blanket for this big baby?

Sure . . . it's in the two little tanks . . . a blanket of Foam

The big tank is full of Styrene, great stuff for the plastics business.

A Styrene fire out of control, like any fire, can be dangerous. The best way to fight it? Throw a blanket of Rockwood FOAM over it.

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Pipeline Patrol

. . . Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way.

U.S. Crude-Oil Pipelines

- **Cape Pipe Line Co.** (organized by Sun Oil Co., Cities Service Co., Atlantic Refining Co.)

  Project: Long range plans for line on the lower Delaware Bay to the Philadelphia refining area.

  Status: Planned.

  Completion: 1960.

- **Cosden Petroleum Corp., Onyx Div.**

  Project: 37 miles of 4, 6-in. main line plus 15 miles of laterals in central and southern Taylor County, West Central Texas, to deliver to Onyx plant at Hawley, Tex.

  Status: To start when weather permits.

  Completion: July 1, 1957.

- **Four-Corners Pipe Line Co.** (newly formed by Shell Oil Co., Standard Oil Co. of California, Continental Pipe Line Co., Gulf Oil Corp., Richfield Oil Corp., Superior Oil Co.)

  Project: 600 miles of line from near Farmington, N. Mex., in the Four Corners area to Los Angeles, to be constructed and operated by Shell Pipe Line Corp. as agent for the companies.

  Status: Under way.

  Completion: End 1957.

- **Fulton, R. H. & Co.,** Lubbock, Tex.

  Project: 39 miles of 6-in. from Donkey Creek field in northeastern Wyoming, southeast to the Osage pump station in Weston County.

  Status: Fulton, a conctractor, has applied to Wyoming Public Service Commission.

- **Great Northern Railway Co.**

  Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and North Dakota, to Clearbrook or St. Paul, Minn.

  Status: Under study.

  Contractor: **Pipe Line Technologists, Inc.** has contract for feasibility study to be finished July or August 1957.

- **Interstate Oil Pipe Line Co.**

  Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.

  Status: Proposed.

- **Magnolia Petroleum Co.**

  Project: 203 miles of 12, 16, and 20-in. loops between Midland and Beaumont, Tex.

  Status: To start August 1957.

  Contractor: **O. R. Burden Construction Corp.** has 121 miles of 16-in. and 5 miles of 12-in. between Midland and Corsicana. **H. B. Zachry Co.** has 77 miles of 12, 16, and 20-in. between Corsicana and Beaumont.

  Completion: Early 1958.

- **Muskegon Pipe Line Corp.** (newly formed by Aurora Gasoline Co. and Service Pipe Line Co.)

  Project: 165 miles of 10-in. from Griffith, Ind., to Muskegon, Mich.

  Status: Planned.

  Completion: Late 1957.

- **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

  Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.

  Status: Proposed.

- **Offshore Gathering Corp., Houston.**

  Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)

  Status: Proposed.

- **Oil Field Pipe Line, Inc.**

  Project: 200 miles 8 and 12-in. line from near Elkhart, to Ellinwood, Kans., at Schurr station of Arapahoe Pipe Line Co.

  Status: Proposed.

- **Pasotex Pipe Line Co.**

  Project: 58 miles of 20-in. between Wink and El Paso, Tex.

  Status: To start in June.

  Contractor: **R. H. Fulton & Co.**

  Completion: September 1, 1957.

- **Salt Lake Pipe Line Co.**

  Project: 100 miles of 10-in. looping of Rangely, Colo., to Salt Lake City line.

  Status: Pipe has been ordered.

  Completion: Late 1957.

- **Shamrock Oil & Gas Corp.**

  Project: 35 miles of 6-in. to serve fields in Ochiltree and Hansford counties in the Texas Panhandle.

  Status: Under way.

- **Shell Oil Co.**

  Project: Undetermined length of 3, 4-in. in South Louisiana.

  Status: Under way.

  Contractor: **Brown & Root, Inc., W. P. Stanley,** spread superintendent, office at Buras, La.

  Completion: September 30, 1957.

- **Sinclair Pipeline Co.**

  Project: 150 miles of 20-in. from **Teague,** Tex., to Houston.

  Status: Planned for 1958.

  Completion: 1958.

- **Skelly Oil Co.**

  Project: 38 miles of 8-in. extension of its gathering system into southern Kiowa County, Kansas.

  Status: Planned.

  Completion: Early fall 1957.

- **Southern Kansas Pipeline, Inc.** (newly organized).

  Project: 200 miles of 6 to 10-in. from southwestern Meade County to a point in Cowley County, 10 miles north of Arkansas City.

  Status: Proposed. Request filed with Kansas Corporation Commission for permit.

- **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)

  Project: 201 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.

  Status: Under way.

  Contractor: **O. R. Burden Construction Corp.** has two spreads of 93 miles from Griffith eastward and 92 miles from the mid-point to Cygnet. The 16 miles from Chicago to Griffith has not been let.

  Completion: September 1957.

- **Texas-New Mexico Pipe Line Co.** (owned by The Texas Co., Sinclair Pipe Line Co., Tidewater Oil Co., and Empire Gas & Fuel Co.)

  Project: 515 miles of 16-in. from southeast corner of Utah to Jal in southeastern New Mexico.

  Status: To start late 1957.

  Contractor: Survey contracts went to **J. V. McCoy,** Houston, and **E. H. Schmidt and Associates,** Tulsa.

  Completion: 1958.

U.S. Products Pipelines

- **Alaska-Yukon Refiners & Distributors, Ltd.**

  Project: Two lines: one 150 miles from

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Pipeline Patrol

Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on the Canol line, to Anchorage.

Status: Proposed.

Completion: 1959.

• **American Pipe Line Co.**

Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.

Status: Proposed.

• **Buckeye Pipe Line Co.**

Project: Conversion of 116 miles of 8-in. crude to products between Huntington, Ind., and Griffith, Ind.

Status: under way.

Contractor: **Sheehan Pipe Line Construction Co.**, C. M. Brown, superintendent, office at Rochester, Ind.

Completion: Fall 1957.

Project: Conversion of 32 miles of 8-in crude to products between Mantua, Ohio, and Youngstown area.

Status: Planned.

Contractor: Company will do own work

Completion: November 1957.

Project: 70 miles of 8-in. from Wayne to vicinity of Durand, Mich.

Status: Pipe ordered.

Completion: Early 1958.

• **Cities Service Pipe Line Co.**

Project: 29 miles of 6-in. ethylene line from Lake Charles, La., to Orange, Tex.

Status: Planned.

Completion: July 31, 1957.

Project: 168 miles of 6-in. L.P.G. line from East Chicago, Ind., to Lowell, Mich.

Status: Under way.

• **Continental Pipe Line Co.**

Project: Conversion of 99 miles of 6-in. from the Wichita Falls area to near Fort Worth, Tex., plus a 15-mile extension of the line to the Grapevine area northeast of Fort Worth.

Status: Conversion under way. Extension planned.

• **El Paso Natural Gas Co.**

Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.

Status: Planned

Project: 240 miles of 6-in. from Odessa to El, Paso, Tex.

Status: Planned.

Contractor: **Pipeline Engineering Co.** has design and engineering contract. **Coutes Field Service, Inc.** has right-of-way acquisition and claims settlement contracts.

Completion: Early 1958.

• **Engineering Management, Inc.**

Project: 58 miles of 10-in. from Richmond to Castle, Calif.

Status: Under way.

Contractor: **Hood Construction Co.**, William Burgess, spread superintendent, office at Sacramento.

Completion: July 1, 1957.

• **Florida Pipeline & Storage Co.**

Project: 67-mile products line from Everglades, Fla., to Homestead Air Force Base, 25 miles south of Miami.

Status: To start in summer.

Contractor: **Fish Service Corp.**

Completion: December 1957.

• **Great Lakes Pipe Line Co.**

Project: 84 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.

Status: Under way.

Project: 15 miles of 6-in. from Lincoln, Neb., to Lincoln air base.

Project: 140 miles of 8-in. from Minneapolis to Superior terminals.

Project: 34 miles of 12-in. from Tulsa to Barnsdall, Okla., to supplement existing 12 and 8-in. lines.

Project: 14 miles of 8-in. from Coffeyville to Independence, Kan., to replace present 4-in line.

Project: 11 miles of 8-in. from approximately 10 miles east of the Great Lakes pumping station at Donahue, Iowa, to terminals on the Mississippi River at Bettendorf, Iowa.

• **Gulf Refining Co.**

Project: 530 miles of 10-in. L.P.G. and natural gasoline line from Waddell Plant in Crane County, Texas, to Mont Belvieu near Houston (368 miles is conversion from crude service).

Status: Under way.

• **Laurel Pipeline Co.** (Gulf Refining Co., Sinclair Pipe Line Co., and The Texas Co.)

Project: 100 miles of 24-in. and 340 miles of line graduating down to 14-in. at the west terminus, from Philadelphia refining area to Cleveland.

Status: To start early 1958.

Completion: 1958.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.

Status: Proposed.

• **Ohio Oil Co.**

Project: 350-miles of 12-in. from Wood River, Ill., to Chicago.

Status: Work to start fall 1957.

Completion: 1958.

• **Salt Lake Pipe Line Co.**

Project: 80 miles of 8-in. looping of line from Boise, Idaho, to Pasco Wash.

Status: Pipe has been ordered.

Completion: Late 1957.

• **Southern Pacific Pipe Lines, Inc.**

Project: 100 miles of 10-in., 80 miles of

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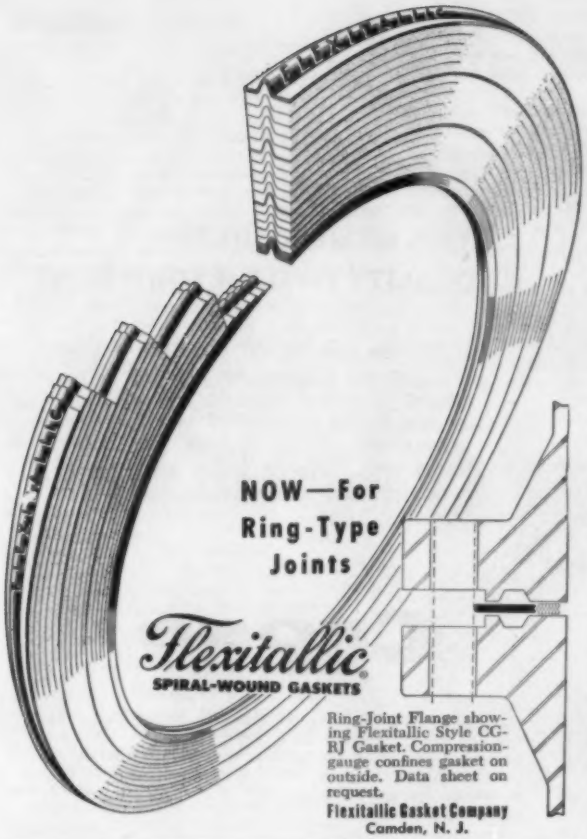

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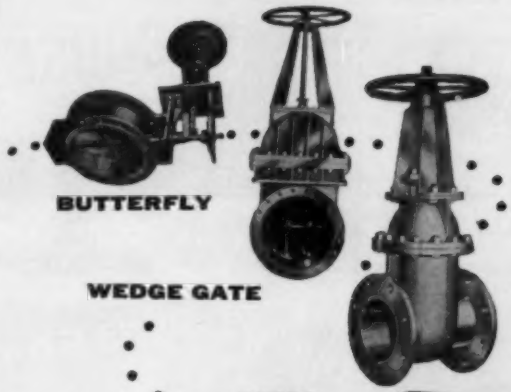

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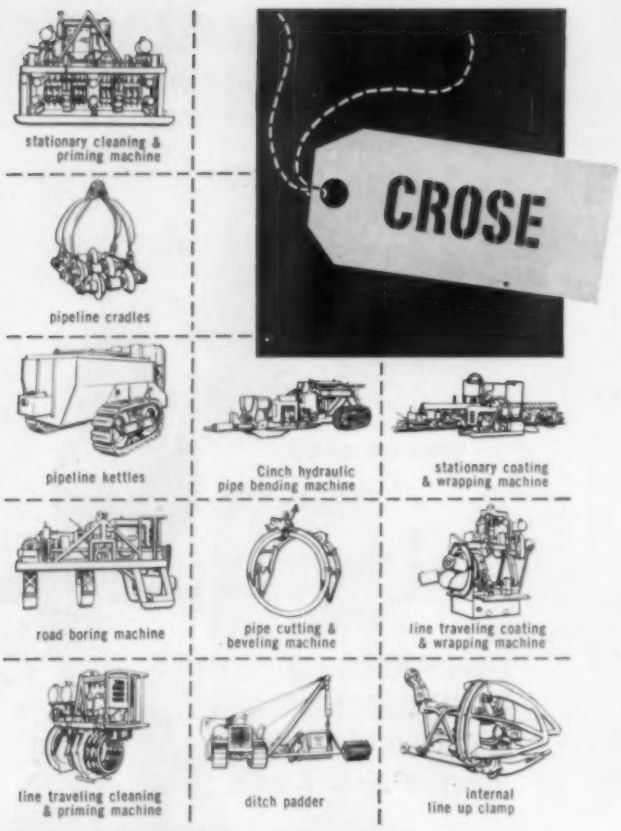

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Pipeline Patrol

8-in., and 125 miles of 6-in. between Richmond, Calif., and Fallon, Nev.

Status: Under way.

Contractor: **River Construction Corp.** has completed 84 miles of 8, 10-in. from Richmond, Calif. **Hood Construction Co.**, Lynwood, Calif., has 58 miles of 10-in. from Stockton to Roseville, Calif. **Engineers, Limited Pipeline Co.** and **Joe E. Young Pipe Line Construction Co.** have 180 miles of 6 and 8-in between Rocklin, Calif, and Fallon, Nev.

Completion: August 1, 1957.

- **Trust Pipe Line Co.** (Cosden Petroleum)

Project: 128 miles of 6-in. from Hawley, near Abilene, to Wichita Falls, Tex.

Status: To start July 1957.

Contractor: **Pipe Line Technologists, Inc.**, has the design and engineering.

Completion: October 1957.

- **Underground Storage & Exploration, Inc.**

Project: 393 miles of 12-in. L.P.G. line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.

Status: Proposed.

- **Union Oil Co. of California**

Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.

Status: Proposed.

U.S. Natural-Gas Pipelines

- **American Louisiana Pipe Line Co.**

Project: 7 miles of 16-in. and 5 miles of 12-in. at North Holly Beach Field and Second Bayou Field, Cameron Parish, La.

Status: Has temporary FPC permit.

- **Arkansas Louisiana Gas Co.**

Project: A 300-mile line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system, plus gathering lines.

Status: Long-range plans.

- **Atlantic Seaboard Corp.**

Project: 14 miles of 26-in. looping in Hardy and Randolph counties, West Virginia.

Status: Has temporary FPC approval.

- **Carolina Pipeline Co.**

Project: 177 miles of 2, 3, 4, 6, 8, and 10-in. between Blacksburg and Camden. S. C.

Status: Under way.

Contractor: **Panama-Williams Corp.** has construction contract. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.

- **Central Hudson Gas & Electric Corp.**

Project: 46 miles of 10-in. from Albany to Kingston, N. Y.

Status: Under way.

Contractor: **Williams-Austin Construction Corp.**, O. L. Martin and Ralph Gaddy, spread superintendents, office at Catskill, N. Y.

Completion: November 1, 1957.

- **Cities Service Gas Co.**

Project: 8 miles of 16-in., 20 miles of 8-in., 20 miles of 6-in., and 20 miles of 4-in. field lines in Barber County, Kansas.

Status: Approved. Under way.

Contractor: **Vaughn & Taylor Construction Co.**

Project: 3 miles of 12-in., 8 miles of 10-in., 4 miles of 8-in., 8 miles of 6-in., and 37 miles of 4-in. field lines in Eureka Field, Okla.

Status: Approved. Under way.

Contractor: **Vaughn & Taylor Construction Co.**

Project: 4 miles of 16-in. at Sarcoxie, Mo.

Status: Approved. Under way.

Contractor: **Prairie Construction Co.**

Project. 64 miles of 6 to 30-in. in Leavenworth and Anderson counties, Kansas, Cass County, Missouri. and Oklahoma County, Oklahoma.

Status: Planned.

- **Coastal Transmission Corp.**

Project: 575 miles of 12, 20, 22, 24-in. main line and 414 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.

Status: To start summer 1957.

Completion: January 1, 1958.

- **Colonial Natural Gas Corp.**

Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.

Status: Proposed.

- **Colorado Interstate Gas Co.**

Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 50 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.

Status: Pending FPC approval. Has temporary approval for the 50-mile, 22-in. section in Oklahoma.

- **Eastern Shore Natural Gas Co.**

Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp. in Maryland, across entire length of Delaware to Salisbury.

Status: Pending FPC approval.

- **El Paso Natural Gas Co.**

Project: 74 miles of 34-in. San Juan main line loops.

Status: Planned. Filed for FPC permit.

Completion: August 1957.

Project: 94 miles of 18-in. from Panoma Plant, Gray County, to Dumas Plant, Moore County, Texas.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: July 1957.

Project: 177 miles of 20-in. from Sonora

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You are welcome to a copy of our 1956 Annual Report as long as the supply lasts. Just write to Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

1. Things we bought and used...58.7%

Most of the money went for things we had to buy, such as crude oil, materials and services, plus charges made for wear and tear. Our company is one of America's largest buyers of goods and services from other companies. We buy everything from paper clips to structural steel from more than 32,000 independent companies in hundreds of American communities.

2. Wages, salaries, benefits...16.0%

Then there were wages, salaries and benefits for our 52,000 employees. Standard Oil employees enjoy one of the broadest, most progressive employee benefit programs in any industry. More than 94% of our eligible employees are participating in savings plans to which the company contributes.

3. Taxes paid...18.6%

The tax collector got his share, too. We paid national, state and local governments $89,130,000 in 1956. In addition, there were the many "hidden" taxes everyone pays, and the direct taxes placed on gasoline. These total direct taxes which we collected from customers and paid to government agencies amounted to $326,779,000.

4. Profits paid to owners...2.5%

After all operating expenses and taxes were paid, 6.7% was left. This is called profit. A part of this or 2.5% of our total income, went as dividends to our 143,200 shareholder-owners. Dividends paid in 1956, including the market value on the date of distribution of the special fourth-quarter dividend in Standard Oil Company (New Jersey) stock, amounted to $2.31 per share. And our company has paid dividends every year for 63 years.

5. Profits used for improvement...4.2%

To serve you better, all the rest of our profits, or 4.2% of our total income, was plowed back into new facilities such as oil wells, refineries, research laboratories, transportation equipment and service stations. Since the end of World War II, we have spent about $2,300,000,000 to help meet the growth in demand and to bring you new and constantly improved products.

6. You're the boss

All the money we took in has been accounted for. At our service stations, our plans and our investments face the final test...for our millions of customers are the bosses. To make high quality petroleum products more easily available to our customers, last year alone we spent more than $37 million on bulk plants, warehouses, service stations.

*What makes a company a good citizen?

Well, one quality of good citizenship is frankness—with employees, stockholders, customers, the public. Because we, at Standard Oil, believe that frankness prevents misunderstandings, we publish reports to our neighbors in advertisements like this so that you will know how we work, something about our Standard Oil family, and the part we play in the economic well-being of the communities in which we live and work.

STANDARD OIL COMPANY (INDIANA) STANDARD

Pipeline Patrol

Plant, Sutton County, to Plains Plant, Yoakum County, Texas.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 74 miles of 30-in. Permian-San Juan main line loops.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 216 miles of 6 to 34-in. in Arizona, Texas, and New Mexico, plus 533 miles of various size line.
Status: Filed for FPC permit.
Project: 47 miles of 30-in. from proposed Lindrith, N. M., plant to proposed Chaco, N. M., plant.
Status: Under way.
Contractor: **Foutz & Bursum Construction Co.**
Completion: 1957.
Project: 38 miles of various size line to make additional gas available for processing at the McElroy-Wilshire gasoline plant (recently purchased from Lone Star Producing Co.) near Crane, Tex.

- **Houston Texas Gas & Oil Corp.**
Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 240 miles of 18-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.
Status: To start June 1957.
Contractor: **Midwestern Constructors** has the 702 miles of 24-in.; **Harbert Construction Corp.** has remainder.
Completion: June 1958.

- **Iron Ranges Natural Gas Co., St. Paul.**
Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.
Status: Application pending with FPC.

- **Kansas-Nebraska Natural Gas Co.**
Project: 61 miles of various size gathering line in Camerick field, Texas County, Oklahoma.
Status: Approved.

- **Michigan Consolidated Gas Co.**
Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.**; Floyd Huduall, spread superintendent, office at Cadillac, Mich.
Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.**, jointly with **J. L. Gentry Construction; Frank** Morris, spread superintendent, office at Hart, Mich.

- **Michigan Wisconsin Pipe Line Co.**
Project: 24 miles of 24-in. and 18 miles of various size looping in Michigan, Indiana, Illinois, Wisconsin, Iowa, and Missouri.
Status: Approved.
Completion: October 1, 1957.

- **Midwestern Gas Transmission Co.**
Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin.
Status: Application pending with FPC.

- **Montana-Dakota Utilities Co.**
Project: 28 miles of 12-in. from Fallon County to Dawson County, Montana.
Status: Approved.
Project: 6 miles of 12-in. between Mandan and Bismarck, N. D.
Status: Has temporary approval.

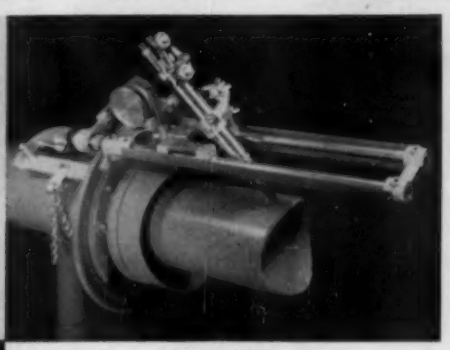
- **Mountain Fuel Supply Co., Salt Lake City.**
Project: 38 miles of line to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.
Status: Has temporary FPC permit.

- **Natural Gas Pipeline Co. of America**
Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., plus a gathering system.
Status: Under way.
Contractor: **R. H. Fulton & Co.** has Red River crossing in northern Montague County. **Fulton & Brodie, Inc.,** Lubbock, Tex., has gathering system.
Completion: Total project to be completed by December 1, 1957.
Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and for 91 miles of 30-in. loops along parts of its main line.
Status: Application pending with FPC.
Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joilet, Ill., along Natural's existing system from the Texas Panhandle to Chicago.
Status: Pending FPC approval.
Completion: 1959.

- **New York State Natural Gas Corp.**
Project: 15 miles of 30-in. from Horseheads to Newfield, N. Y.; 31 miles of 20-in. from Harrison to Woodhull, N. Y.; 10 miles of 12-in. from Stockbridge to Oneida, N. Y.
Status: Planned.

- **Niagara Mohawk Power Corp.**
Project: 14 miles of 18-in. from Phoenix to Palermo, N. Y.
Status: Planned.
Completion: October 1, 1957.
Project: 261 miles of 2 to 16-in. transmission and distribution mains to service areas

Torch control



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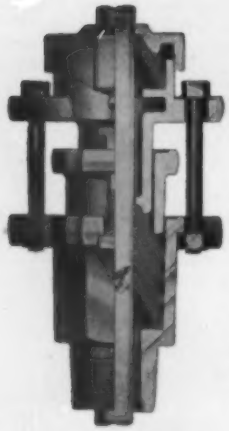

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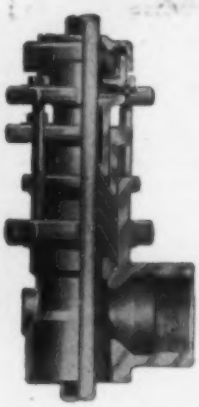

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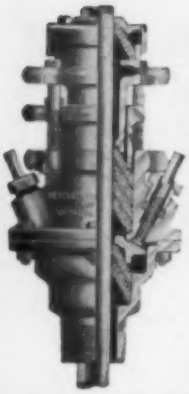

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Pipeline Patrol

in central, eastern and northern New York state.

Status: Planned.

Contractor: Various.

Completion: December 31, 1957.

• **North Carolina Natural Gas Corp.** (Subsidary of Colonial Natural Gas Corp.)

Project: 630 miles of 2 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across north Carolina.

Status: To start fall 1957.

Completion: Spring 1958.

• **Northern Natural Gas Co.**

Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.

Status: Under way.

Contractor: **Troth Construction Co.**

Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

Status: Planned.

Project: 365 miles of main line and 1,090 miles of branch lines to serve communities in Minnesota, Iowa, South Dakota, Nebraska, and Wisconsin.

Status: Filed with FPC March 18, 1957.

• **Offshore Gathering Corp.,** Houston.

Project: 364 miles in Gulf of Mexico off Louisiana.; 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)

Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**

Project: 7 miles of 12-in. near Fremont, Ohio.

Status: Planned.

Completion: First half 1957.

Project: 23 miles of 18, 20-in. from Gibsonburg to Toledo.

Status: Uncertain.

Project: 152 miles of line in Ohio: 43 miles of 24-in. from Crawford Station to Utica; 18 miles of 24-in. from Pavonia Station to Line D; 6 miles of 20-in. from Mount Gilead to Claridon; 4 miles of 20-in. near Dayton; 4 miles of 20-in. near South Charleston; 7 miles of 16-in. near Springfield; 6 miles of 20-in. nnear Oberlin; 17 miles of 20-in. from Oak Hill to Symmes Station; 7 miles of 12-in. from Mount Sterling to Bloomingburg; 2 miles of 8-in. near Bellefontaine; 3 miles of 12-in. near Mansfield; 4 miles of 12-in. near Lakeville; 7 miles of 8-in. in Guernsey and Belmont counties.

Status: Under way.

Contractor: **O. R. Burden Construction Corp.** has the 43 miles of 24-in. from Sugar Grove near Crawford station, to Utica, Ohio, C. M. Hoffman, spread superintendent.

Completion: O. R. Burden Construction Corp., section to be completed July 1, 1957. Remainder to be completed second half 1957.

• **Pacific Gas & Electric Co.**

Project: 37 miles of 20-in., 37 miles of 18-in., 3 miles of 16-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento.

Status: Under way.

Contractor: **Engineers Limited Pipeline Co.**

Completion: June 1957.

Project: 138 miles of 34-in. looping of the Topock-Milpitas line.

Status: Under way.

Contractor: **Midwestern Constructors, Inc.**

Completion: December 1, 1957.

Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 6-in. from Corning to Eureka, Calif., to connect company's Humboldt Division with integrated gas system.

Status: Planned.

Completion: January 1958.

Project: 13 miles of 12-in., 2 miles of 10-in., from Santa Cruz to Davenport, Calif.

Status: Planned.

Completion: October 1957.

• **Pacific Northwest Pipeline Corp.**

Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America.

Status: Has FPC permit.

Project: 1,000 miles of gathering lines and laterals along present line.

Status: Planned.

Completion: 1957.

• **Pennsylvania Gas Co.**

Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pennsylvania, 30 miles of branch lines and a number of small distribution systems.

Status: Has FPC permit.

• **Peoples Natural Gas Co.**

Project: 58 miles of 2 to 14-in. extension and replacement lines in Pennsylvania.

Status: Under way.

Completion: September 1957.

• **Permian Basin Pipeline Co.**

Project: 83 miles of 16-in. from its Spraberry station in Midland County, Texas, to tie in with Pioneer Gathering System, Inc., at a point in northwestern Schleicher County, Texas.

Status: Filed for FPC approval.

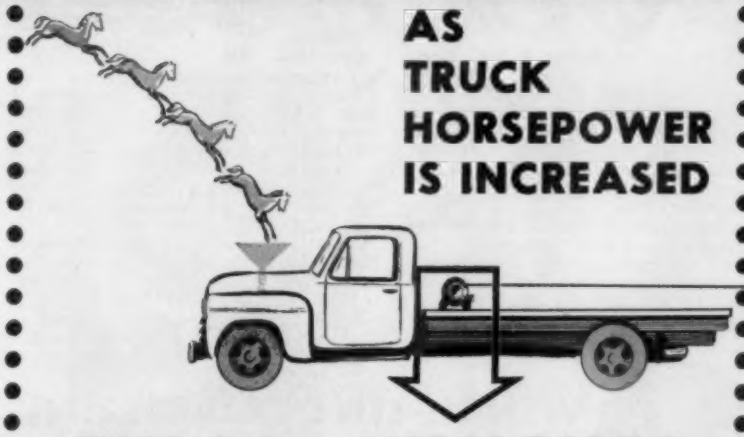
• **Phillips Petroleum Co.**

Project: 3 miles of 24-in. in Moore County, Texas.

Status: Planned.

Completion: October 1, 1957.

Project: 30 miles of 3 to 8-in. in Moore, Hutchinson, Sherman, Hansford, and Gray



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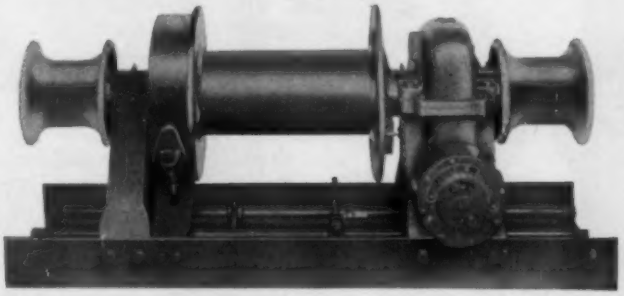

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Pipeline Patrol

counties, Texas, and in Texas County, Oklahoma.

Status: Planned.

Contractor: Various.

Completion: January 1, 1958.

• **Piedmont Gas Co.**, Hickory, N. C. (Parent is Carolina Natural Gas Corp.)

Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell and Burke counties.

Status: Has FPC approval.

• **Pioneer Gathering System, Inc.**

Project: 27 miles of 16-in. and 27 miles of 12-in. in Schleicher and Sutton counties, Texas.

Status: Filed for FPC approval.

Completion: July or August 1957.

• **Signal Oil & Gas Co.**

Project: 80 miles of gathering lines serving Tioga, N. D., gasoline plant; system being extended to Antelope, North Blue Buttes, and South Blue Buttes fields, McKenzie County, North Dakota.

Status: Under way.

Contractor: **C. P. Bartley & Son**, Tioga, N. D.

Completion: October 1, 1957.

• **Southern California Edison Co.**

Project: 200-mile line from San Joaquin Valley gas fields to power plant at Redondo Beach, Calif.

Status: Under way.

Completion: 1957.

• **Southern California Gas Co. and Southern Counties Gas Co. of California.**

Project: 241 miles of 30-in. from the outskirts of Los Angeles to Topock on the Arizona-California border.

Status: Under way.

Contractor: **R. H. Fulton & Co.**, spread offices at Palmdale and Barstow, Calif.

Completion: June 30, 1957.

Project: 4 miles of 30-in. from Los Angeles River to Victoria Station at Los Angeles.

Status: Planned.

Completion: July 30, 1957.

• **Southern Natural Gas Co.**

Project: 10 miles of 8-in. laterals in Napoleonville Field and Fort Jackson Field, La.

Status: Has FPC approval.

Completion: December 1, 1957.

Project: 32 miles of 6-in. from Chandeleur Sound area, Breton Island, La.; 7 miles of 8-in. and 5 miles of 10-in. from Main Pass area to Olga, La.; 9 miles of 8-in. from Bastian Bay Field to Fort Jackson Field; 7 miles of 8-in. laterals in Manila Village Field.

Status: Plan to apply for FPC permit.

Completion: December 1, 1957.

• **Spokane Natural Gas Co.**

Project: 400 miles of 1 through 24-in. distribution system at Spokane.

Status: Under way.

Contractor: **Hallmac Construction Co.**; V. L. Williams, spread superintendent, office at Spokane.

Completion: 1957.

• **Tennessee Gas Transmission Co.**

Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.

Status: Pending FPC approval.

Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.

Status: Has temporary FPC approval.

Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.

Status: Pending FPC approval.

Project: 76 miles of 24-in. between Coudersport, Pa., and Hamburg, N. Y.

Status: Pending FPC approval.

• **Texas Eastern Transmission Corp.**

Project: 422 miles of 30-in. from near McAllen to Beaumont, Tex., to move imported Mexican gas; 45 miles of 24-in. laterals from McAllen to Provident City, Tex., 77 miles of 30-in. looping between Kosciusko, Miss., and Uniontown, Pa.; 147 miles of supply and sales laterals.

Status: Under way.

Contractor: **Houston Contracting Co.** has completed 121 miles of 30-in. between Angleton and Vidor, Tex. **H. C. Price Co.** has completed 70 miles of 30-in. **H. B. Zachry Co.** has 201 miles of 30-in. starting near McAllen and running northeast to near Angleton, Tex. **Grayco Constructors, Inc.** has completed 45 miles of 24-in. laterals from Blessing to Provident City. **Western Pipe Line, Inc.**, Austin, has completed 30-in. crossings at Nueces, Lavaca, and Carancahua bays. **Missouri Valley Dredging Co.**, Omaha, has completed crossings at Hinds and Guadalupe bays. **Altgelt Construction Co., Inc.**, has 100 miles of 3, 4, 6, 8-in. gathering lines in the Corpus Christi area.

Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.

Status: Has FPC approval.

Project: 97 miles of 30-in. loops between Kosciusko, Miss., and Uniontown, Pa., and 10 miles of new lateral supply lines.

Status: Filed for FPC permit March 15, 1957.

Completion: September 1, 1957.

Project: 667 miles of 30-in. from Kosciusko, Miss., to Uniontown, Pa.

Contractors: **H. C. Price Co.** has 64 miles from Barton, Ala., to Mt. Pleasant, Tenn., 51 miles from Mt. Pleasant to Gladeville, Tenn., 52 miles from Gladeville to Tompkinsville, Ky., 68 miles from Tompkinsville to Danville, Ky., 63 miles from Danville to Owingsville, 46 miles from Owingsville to Wheelersburg, Ohio. (Four spreads will be used). **Williams Brothers Co.** has 63 miles from Egypt, Miss., to Barton, Ala., 64 miles from Berne, Ohio, to Uniontown, Pa. **Houston Contracting Co.** has 80 miles from Kosciusko, Miss., to Egypt, Miss., 57 miles from Wheelersburg to Athens, Ohio, 61 miles from Athens to Berne, Ohio.

Completion: Fall 1957.

• **Texas Illinois Natural Gas Pipeline Co.**

Project: 10 miles of 36-in. to loop existing single 30-in. near Joliet, Ill.

Status: Has FPC approval.

• **Transcontinental Gas Pipe Line Corp.**

Project: 172 miles of 36-in., 68 miles of 30-in., 162 miles of 24-in., and 64 miles of smaller diameter pipe to loop main line from Texas to New Jersey.

Status: Work in North Carolina under way.

Contractor: **Western Construction Co.** has 65 miles of 36-in. and 45 miles of 30-in. at scattered spots along the system in South Carolina, North Carolina, Pennsylvania, and Virginia. Western will start work in North Carolina, spread office at Winston-Salem.

Completion: Total project to be completed December 1957.

Project: 110 miles of 36-in., 16 miles of 30-in., and 13 miles of 24-in. looping in S. Car., Ga., Ala., Miss., and La.

Status: Under way.

Contractor: **Sharman, Allen, Gay & Taylor, Inc.**

Completion: November 1957.

Project: 29 miles of 16-in. lateral off the coast of Cameron Parish, La., and ex-

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tending to company's existing system near Lake Charles.

Status: Approved. Under way.

Contractor: **Sharman Allen, Gay & Taylor, Inc.**

Project: 57 miles of main line in Louisiana, Mississippia, Alabama, Georgia, and South Carolina, and 226 miles of laterals in Texas and Louisiana.

Status: Filed for FPC permit, May 3, 1957.

• **United Gas Pipe Line Co.**

Project: 40 miles of 8-in. from Baldwin County, Alabama, to Container Corp.'s plant.

Status: Has FPC permit.

Canadian Crude-Oil Pipelines

• **Act Oils, Ltd.** (subsidiary of Canada Southern Petroleums, Ltd.)

Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Bella Coola, B. C.

Status: Request has been made for permit from the B. C. government.

• **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.

Status: Pending approval.

• **Gibson Crude Oil Purchasing Co., Ltd.**

Project: 19 miles of 6-in. from the Bellshill Lake oil field, Northeastern Alta., to tie in with Interprovincial Pipe Line's pump station near Hardisty, plus 3 miles of lateral lines.

Status: To start as soon as weather permits.

Contractor: **Hutchison Construction, Ltd.,** of Leduc, Alta., has construction contract. **Petrol-Structors, Ltd.,** of Calgary, are designing and supervising construction.

Completion: Late June, 1957.

• **Interprovincial Pipe Line Co.**

Project: 156 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.

Status: Under way.

Contractor: **Somerville Construction Co.** has 90 miles; **Majestic Contractors, Ltd.,** has 66 miles, Earl Saulsman, spread superintendent, office at Galt.

Completion: September 1, 1957.

Project: 33 miles of 24-in. from Kendal to Peebles, Sask.

Status: Under way.

Contractor: **Fulton Banister, Ltd.,** John O'Rourke, superintendent, office at Wolseley, Sask.

Completion: July 31, 1957.

Project: 79 miles of 26-in. from Clearbrook, Minn., to Superior, Wis.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: August 31, 1957.

• **Pembina Pipe Line, Ltd.**

Project: 100 miles of 3 to 12-in. gathering line in Pembina oil field.

Contractor: **Universal Pipe Line, Ltd.,** subsidiary of Mannix, Ltd., T. Childress, spread superintendent, office at Drayton Valley, Alta.

Completion: November 1, 1957.

Project: 32 miles of 16-in. from Calmar to Edmonton, Alta.

Status: Under way.

Contractor: **Universal Pipe Lines, Ltd.,** subsidiary of Mannix, Ltd., Otis Hare, spread superintendent, office at Calgary, Alta.

Completion: July 1, 1957.

• **Rangeland Pipe Line Co.**

Project: 48 miles of 12-in. between Sundre and the Sylvan Lake in south-central Alberta.

Status: Under way.

Contractor: **Dutton-Williams Brothers, Ltd.**

Completion: June 15, 1957.

• **Royalite Oil Co., Ltd.**

Project: 250 miles of line to move oil from the Athabasca oil sands of northeastern Alberta to Edmonton.

Status: Long range plans.

Completion: 1960.

• **Trans Mountain Oil Pipe Line Co.**

Project: 100 miles of 30-in. loops: 50 miles east of Kamloops, B. C., and 50 miles west of Edson, Alta.

Status: Under way.

Contractor: **Marine Pipeline & Dredging, Ltd.,** has Thompson River crossing, B. C., J. H. McCartney, spread superintendent, office at Kamloops, B. C. **R. A. Conyes Construction Co.** has the 50 miles east of Kamloops; **Dutton-Williams Brothers, Ltd.** has the other 50 miles.

Completion: River crossing will be done by June 15, 1957; remainder by July 31, 1957.

• **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields; 14 miles of 4, 6, 8-in. gathering lines.

Status: Has requested permit from Board of Transport Commissioners.

Contractor: **Majestic Contractors, Ltd.,** Jeff Minter, spread superintendent, office at Estevan, Sask.

Completion: No date set.

Project: 75 miles of 16-in. from Steelman, Sask., to Cramer, Man., Canada.

Status: Under way.

Completion: July 30, 1957.

Canadian Products Pipelines

• **Hydrocarbons Pipeline Co.** (Subsidiary of Canadian Hydrocarbons).

Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.

Status: Has permit from Parliament of

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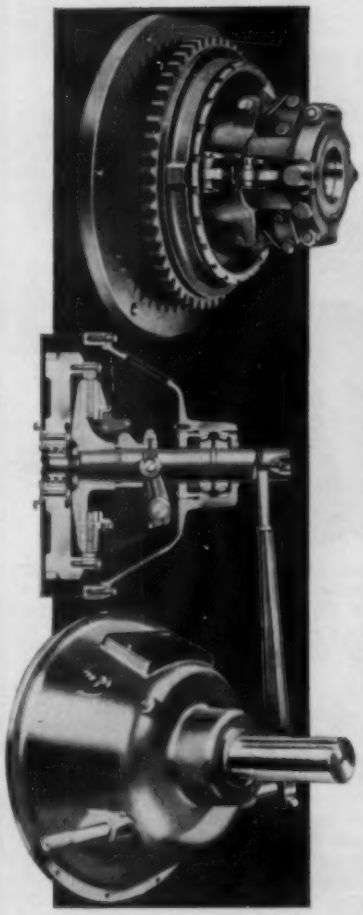

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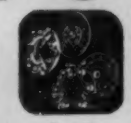
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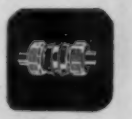
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CLUTCHES

Pipeline Patrol

Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start in 1957.

Construction consultants: **Dutton-Williams Brothers, Ltd.**, Calgary, and **A. D. Little & Co.**, Boston.

Canadian Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.

Contractor: **Dutton-Williams Brothers, Ltd.** has preliminary studies, design and management-engineering. **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.**, has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.**, has 17 miles of 34-in. west from Trans-Canada pipeline origin near Burstall, Sask., to near Cavendish, Alta.; and 100 miles of 18-in. north to Bindloss and Provost fields, John O'Rourke and George Caron, superintendents, office at Empress, Alta.

Status: River crossing completed. Total project to be completed in 1960.

Project: 17 miles of 34-in. west from Trans-Canada pipeline origin near Burstall, Sask., to near Cavendish, Alta.; 100 miles of 18-in. north to Bindloss and Provost fields.

Status: Under way.

Completion: Summer 1957.

• **Inland Natural Gas Co., Ltd.**

Project: 304 miles of mainline and 23 miles of laterals from Savona to Nelson, B. C.: 150 miles of 12-in.; 112 miles of 10-in., 67 miles of 6-in. Also will build 400 miles of distribution piping in 31 towns.

Status: Under way.

Contractor: **Dutton-Williams Brothers, Ltd.** Pat Campbell, project manager, office at Penticton.

Completion: October 1, 1957.

• **Northern Ontario Pipe Line Crown Corp.** (formed by the federal and Ontario governments).

Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line. Upon completion this section will be leased to Trans-Canada Pipe Line Co. with option to buy.)

Status: Part of preliminary work under way. Pipe laying on 79-mile section from Stedman to Forham Township to start July 1, 1957.

Contractor: **Dutton Williams Brothers** has 58 miles from the Manitoba-Ontario border west of Kenora to a point east of the crossing of Ontario Highway 17. **Morrison Shivers, Ltd.** has 94 miles from the east crossing of Highway 17 to a line separating the townships of Hyndman and Hodgson. **Majestic Contractors & Associates** has 80 miles from the Morrison Shivers terminal to Stedman Township. **Houston Contracting Co.** has 79 miles from Stedman to Forham Township, R. L. Silar, spread superintendent, office at Port Arthur, Ont. Remainder not let.

Completion: End 1957.

• **Plains-Western Gas & Electric.**

Project: 16 miles of 10-in. from the Trans-Canada Pipe Line to Brandon, Manitoba.

Contractor: **Banister Construction, Ltd.**, Jim Boyce, superintendent.

Completion: 1957.

• **Saskatchewan Power Corp.**

Project: 13 miles of 4-in. lateral to town of Kerrobert, and 10 miles of 6-in. lateral to Kindersley Power Plant, Sask.

Status: Planned.

Contractor: **Banister Construction, Ltd.**

Completion: July 15, 1957.

Project: 300 miles of 1 to 20-in. distribution lines at Regina, Sask.

Status: Planned.

Contractor: **S. E. Construction (Alberta), Ltd.**, and **Pacific Pipeline Construction (Alberta), Ltd.**, jointly.

• **Trans-Canada Pipe Lines, Ltd.**

Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. (First part of 2,250-mile line from Alberta to Toronto and Montreal. One 675-mile section is being built by Northern Ontario Pipeline Crown Corp.)

Status: Under way.

Contractors: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leonard, spread supt., office at Cabri.; **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., J. L. Work, general supt., office at Moose Jaw, and 54 miles from Portage la Prairie to Winnipeg); **Universal Pipe Line, Ltd.**, subsidiary of **Mannix, Ltd.**, (90 miles from Moose Jaw to Welseley, spread superintendent, Otis Hare, office at Regina, Saskatchewan); **Dutton-Williams Brothers, Ltd.** (97 miles from Deveren to Moosomin, under way, to complete August 1957). **Price-Poole of Canada, Ltd.**, has 100 miles from Miniota to near McGregor.

Completion: September 1957.

Project: 82 miles of 30-in. from near Winnipeg to the Ontario-Manitoba border.

Status: Under way.

Contractor: **Majestic Contractors, Ltd.**, K. B. Killingsworth, spread superintendent, office at Ste. Anne, Man.

Completion: October 15, 1957.

• **Union Gas Co. of Canada, Ltd.**

Project: 142 miles of 26-in. from Dawn Township to Hamilton, Ontario, plus 55 miles of 6 to 20-in. laterals, and 317 miles of 2 to 12-in. distribution lines.

Status: Planned.

Completion: November 30, 1957.

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Motor Division • Springfield, Ohio

Pipeline Patrol

Project: 17 miles of 8 to 20-in. storage lines in Dawn Township, Ontario.
Status: Planned.
Completion: August 1957.

• **Westcoast Transmission Co., Ltd.**
Project: 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash.
Status: Under way.
Contractors: **Dutton-Williams Brothers, Ltd.**, has 120 miles from Taylor, B. C., to Azouzetta Lake, completed; **Universal Pipe Lines, Ltd.**, subsidiary of **Mannix, Ltd.**, has 110 miles between Huntingdon and Kingsvalle, B. C., F. L. Byers, spread superintendent, office at Hops, B. C.; **Canadian Bechtel, Ltd.**, has 210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.; **R. A. Conyes Construction Co.**, has 210 miles; **River Construction Corp., Ltd.**, has under way 150 miles of gathering lines in northern Alberta and British Columbia; **Marine Pipeline & Dredging, Ltd.**, has Fraser and Peace River crossings, Waldo Trim, spread superintendent, offices at Fort Saint John and Hope, B. C.
Completion: Dutton-Williams section completed. R. A. Conyes section and Canadian Bechtel section to be completed September 1957. Marine Pipeline work to be completed June 30, 1957. Universal Pipe Lines, Ltd. will complete work September 1, 1957.
Project: 174 miles of 30-in. from Savanna Creek area to the Canadian-Idaho border.
Status: Proposed.

Foreign Crude-Oil Pipelines

• **Aramco-I.P.C.-Iranian Consortium.**
Project: 1,500 miles of 38 or 40-in. line from Persian Gulf to Mediterranean at Iskenderun, Turkey.
Status: Proposed.

• **Bolivian Gulf Oil Corp.**
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
Status: Awaiting pipe.
Contractor: **Williams Brothers Co.**
Completion: December 1957.

• **Caltex**
Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles of Minas field later.
Status: Planned.
Completion: Duri-Dumai line to be finished in 1959; extension to Minas later.

• **Colombian Petroleum Co.**
Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
Status: Under way.

• **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**
Project: Two 10-in. lines from Hassi Messaoud and Edjele, Algeria to the railhead at Touggourt.
Status: Planned.
Completion: 1958.

• **Creole Petroleum Corp.**
Project: 87 miles of 30-in. from Temblador field to Caripito in Venezuela.
Status: Planned.
Completion: 1959.
Project: 9 miles of 26-in. from Ule to La Salina in Venezuela.
Status: Planned.
Completion: Late 1957.

• **Deutsche-Shell A.G.**
Project: 120 miles of 20, 24-in. from Marseilles, France, to Rotterdam, Germany, to tap the proposed 700 mile trans-Europe line being considered by the Royal Dutch-Shell Group.
Status: Planned.
Completion: 1960.

• **Iraq Petroleum Co.**
Project: About 600 miles of up to 40-in. from Kirkuk field through Iraq and Turkey to the Turkish port of Iskenderun on the Mediterranean sea.
Status: Proposed. Survey completed.

• **Mene Grande Oil Co.**
Project: 97 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.
Status: Under way.
Contractor: **Fulghum Contracting Corp.** has 22 miles between Oficina and Anaco.
Completion: First quarter 1958.

• **Sinclair Oil Corp. and Socony Mobil Oil Co.**
Project: 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.
Status: Under way.
Contractor: **Williams Brothers Sudamericano, Ltd.**
Completion: July 1957.

• **Standard-Vacuum Petroleum Maatschappij.**
Project: 94 miles of 8-in. from Lirik field, Central Sumatra, to deep-water terminal on Siak River, near Buatan. A 3-in. hot-water "defroster" line will be laid under the 8-in. to heat the heavy crude.
Status: Under way.
Completion: Late 1957.

Foreign Products Pipelines

• **Empresa Nacional de Petroleos** (Government of Chile) and **Cia. de Petroleos de Chile (Copec), et al.**
Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.
Status: Planned.
Contractor: **Williams Brothers** has design and engineering contract.
Completion: Design plans will be completed August 1, 1957. No date for construction has been set.

• **Israeli Government**
Project: A 6-in. line from the Haifa refinery to Tel Aviv.
Completion: Late 1957.

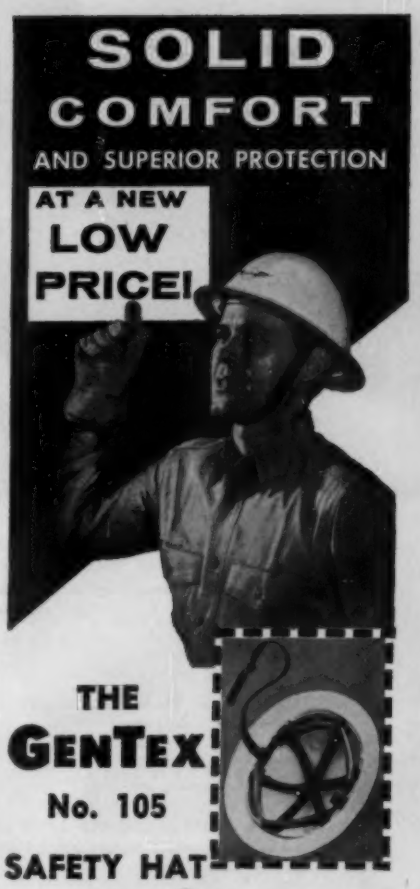
• **Yacimientos Petroliferos Fiscales** (Argentina).
Project: 497 miles from Mendoza to Buenos Aires.
Status: Proposed.

Foreign Natural-Gas Pipelines

• **Cia. Shell de Venezuela.**
Project: 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces.
Status: Under way.
Contractor: **Williams Brothers Co.**
Completion: 1957.

• **Gaz de France**
Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. lateral to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.
Status: Right-of-way work under way.
Contractor: Being handled by French contractors.
Completion: First stage in 1958; complete system in 1960.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**
Project: 207 miles of 26-in. from Anaco fields to Caracas.
Status: Under way.
Contractor: **Fulghum Contracting Corp.** will be consultants; **Petrogas, S. A.** will engineer and construct the line.
Completion: Spring 1959.
Status: Under way.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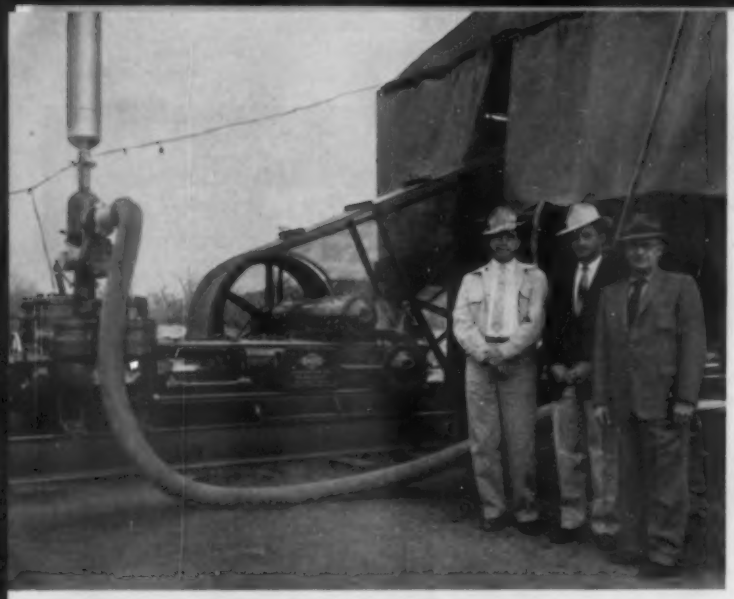

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Among the Drilling Contractors

Falcon Seaboard Finals Subsidiary Organization

E. L. Walton has been appointed general manager; Mahlon A. Mundy, drilling superintendent; and Ernest Neipp, office manager, of D & D Drilling Co., Falcon Seaboard Drilling Co.'s recently acquired subsidiary in Venezuela.

These appointments were announced by Jerry Stauss, executive vice president of the Falcon Seaboard organization, who has just returned from South America to his Tulsa headquarters.

They complete the integration of D & D Drilling Co. within the Falcon Seaboard setup, T. N. Law, president, stated.

Walton, native of East Texas, worked 18 years in Mid-Continent and California oil fields, was an executive with International Petroleum Corp. in Peru, and, from 1948 to 1954, was with Mene Grande Oil Co. in Venezuela before joining the D & D organization.

Mundy has had nearly all his oil experience in South America. He has worked in Columbia and Chile, as well as in Venezuela. Before joining D & D in 1956, he was drilling superintendent for Venezuela Atlantic Oil Co.

Neipp, a native of Germany, started his oil career after World War 1 with Ands Koch. He has specialized in oil accounting and management. He has held various posts with Argentine de Petroleo, S.A.; Paschold & Trautschold, Hamburg, Germany; Shell de Venezuela, Ltd., Maracaibo; Armco Venezolana, C.A., Caracas; and Gaseosas Orientales, S.A., Barcelona. He came to D & D as chief accountant and office manager in 1953.

Tex-Mex Drilling Co., Dallas, has a new deep operation going in northwestern Marion County, northeastern Texas. It is a contract job for Great Expectation Oil Corp. and Amerada Petroleum Corp. Location, at 1 Signal, is about 14 miles northwest of Jefferson. Projected depth of 9,300 ft. should take the hole into the Cotton Valley section.

A. W. Williams Drilling Co., Mobile, Ala., has contracted for a 5,000-ft. test at a rank wildcat location in western Carroll County, northern Mississippi. It will be drilled for Argee Oil Co. at 1 Hemphill in 15-19n-2e. Location is about 10 miles west of Carrollton and about 6 miles east of Greenwood, LeFlore County.

Baker Joins Schoenfeld, Dissolves Own Company

L. W. Baker, formerly president of Baker-Munday Drilling Co., Tulsa, now is associated with Schoenfeld-Hunter-Kitch Drilling Co., also of Tulsa, W. C. Schoenfeld, president of the latter firm, announces.

Baker recently dissolved his Baker-Munday Drilling Co. following purchase of the interest of his partner, A. G. (Doc) Munday.

The Schoenfeld company operates extensively in West Texas and New Mexico. It maintains an office and yard at Odessa, Tex.

Salt Dome Production Co., Houston, has contracted one of its rigs to Kerr-McGee Oil Industries, Inc., for a 9,500-ft. test in Block 50, Main Pass area, in Breton Sound off the east coast of Plaquemines Parish, Louisiana.

Cree Drilling Co., Inc., Pampa, Tex., has a rig working for Horizon Oil & Gas Co., of Amarillo, Tex., at a wildcat location 2 miles northwest of Waka, in Ochiltree County, Texas Panhandle. The test, scheduled to go to 8,500 ft., is Horizon's 1-57 Weicker. It is 3 miles northwest of Farnsworth field, productive from upper Morrow sand. Spot location is in Section 57, Block 4, GH&H Survey.

South States Drilling Co., Longview, Tex., has contracts for two Woodbine tests to be drilled for F. R. Jackson in northwestern Houston County, near the Anderson County line, in East Texas. Locations are 8 to 10 miles northwest of Grapeland. The first to be drilled will be 1 Mathews, in the John Edens Survey. Next will be 1 Durnell, in the S. C. Collison Survey. They will be 6,200-ft. tests.

Neva Andre Drilling Co. is keeping a rig working for Natural Gas & Oil Co., of New Orleans, in the Manila Village area, Jefferson Parish, southeastern Louisiana. From its latest deep operation (1-B L.L.&E.) in the field, it is going to a stepout location at 1-C

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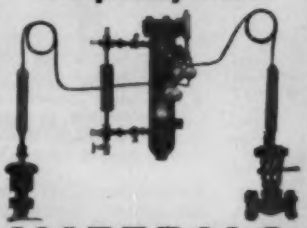

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L.L.&E., about 1½ miles southwest of production. This will be a 12,500-ft. test.

Pernie Bailey, Houston, has a rig under contract to Union Oil Co. of California and Highland Oil Co. for a 9,050-ft. test in the Avondale area, southwest of New Orleans, in northern Jefferson Parish, Louisiana. Location is at 1 Robichaux, in 69-13s-22e.

Crow Drilling Co., Shreveport, is to drill a 9,500-ft. test on the east side of Washington field, in St. Landry Parish, southern Louisiana. It is a contract job for Lamson & Bennett and Texas Gas Exploration Co. Location is on the operator's Gay tract, in 34-4s-5e. It is about ¾ mile from nearest production.

Jett Drilling Co., Shreveport, has a rig running at a remote wildcat location 8 miles northeast of St. Francisville, in West Feliciana, most-western of Louisiana's "Florida" parishes. It is a 10,000-ft. test for O. W. Killam, of Laredo, Tex., at 2 Johnson, in 80-2s-2w.

Sooner Well Service Co. is putting down a 6,500-ft. test for Melba Production Co. at a wildcat location 5 miles southeast of Sandia, in northeastern Jim Wells County, South Texas. Location is listed as 1 Knolle et al, in the Sovars & Gallagher Subdivision, Block 11, Casa Blanca Grant.

R. W. Rine Drilling Co., Wichita, Kans., is on a new Sunray Mid-Continent Oil Co. test in the Laverne gas area, in southwestern Harper County, northwestern Oklahoma. It is a 7,500-ft. Chester test at 1 Pryor, in 1-25n-26w, on the northeast side of the gas area.

Bilbo-Redding Drilling Co., Houston, is drilling on a 9,000-ft. test a mile off the west flank of the old Big Creek dome, 10 miles south of Richmond, in Fort Bend County, Texas Gulf Coast. It is a contract job for J. S. Michael, of Houston. Location is at 1 Thieleman, in the Asa Wickson Survey.

Chance Drilling Co., Houston, has taken on a contract for a projected 15,000-ft. test Tennessee Gas Transmission Co. is getting ready to drill in the far-southeast sector of Jefferson Davis Parish, southern Louisiana. Location, at 1 Morgan Plantation, in 38-11s-4w, is 4½ miles southeast of the large Lake Arthur field, and about 2½ miles northwest of South Lake Arthur field, across the line in northwestern Vermilion Parish.

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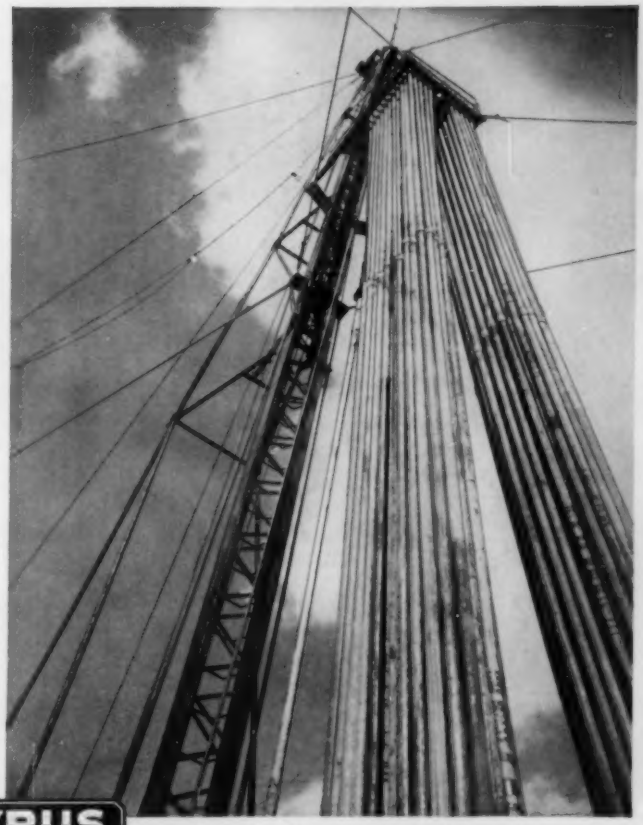

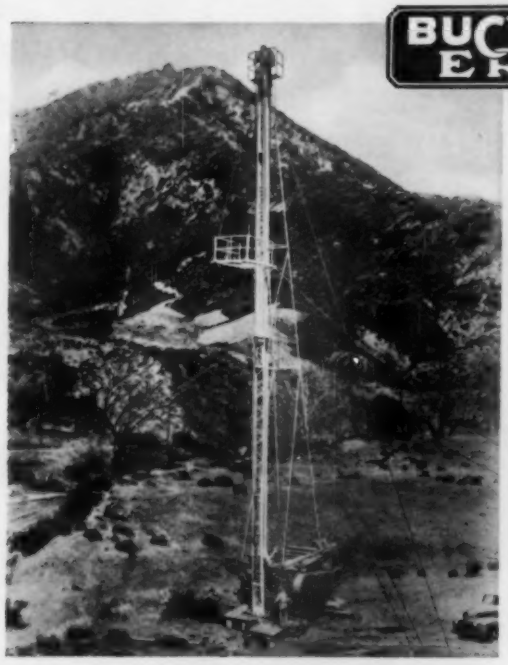

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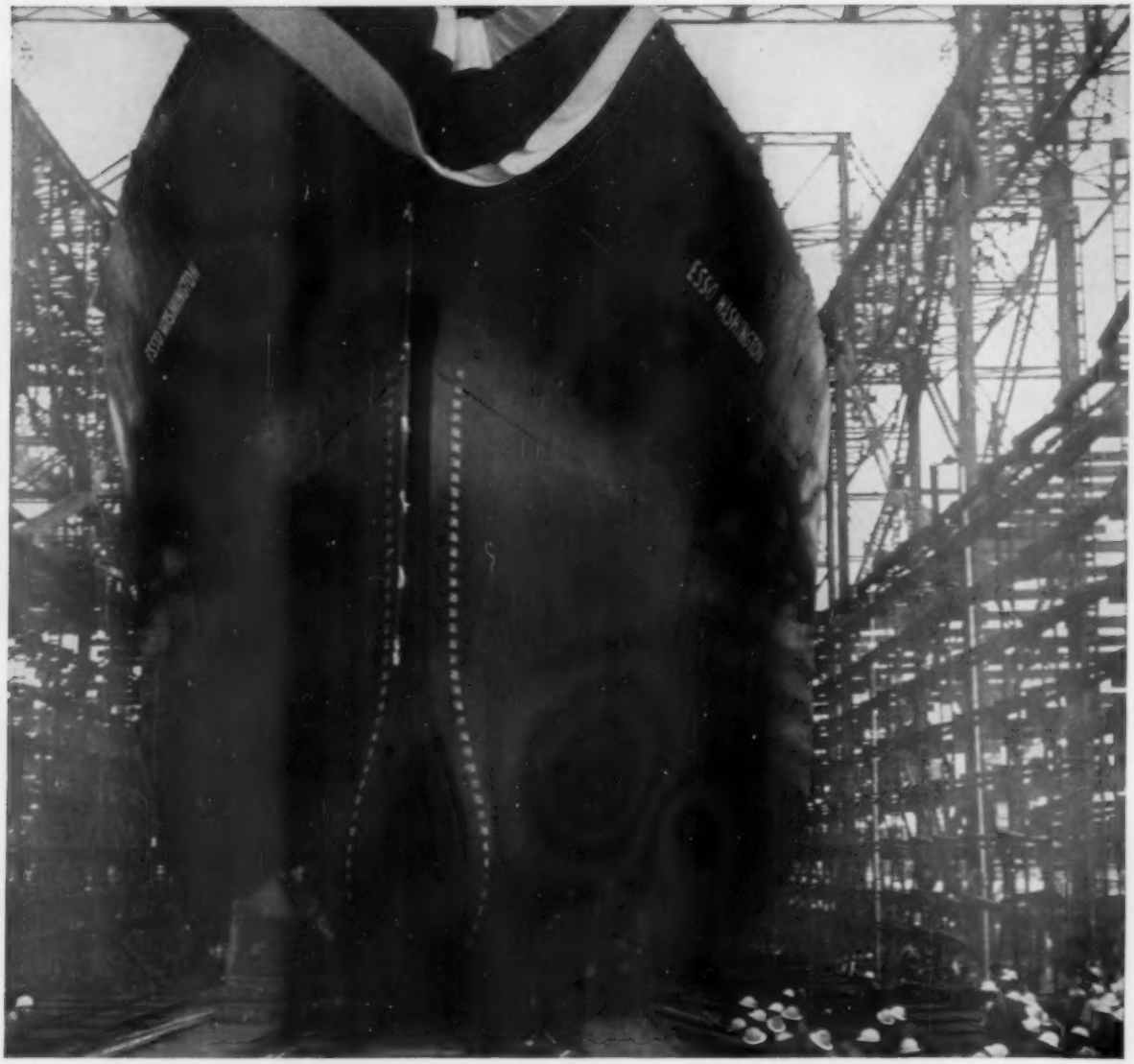


13 MILLION GALLONS BIG...BUT JUST A DROP IN THE BUCKET

The ESSO WASHINGTON is the newest of the 110 ocean-going tankers in the Esso fleets. She can carry 13 million gallons of oil. But that's just a drop in the bucket compared with the 40 billion gallons that Jersey Standard affiliates delivered to customers last year.

As economies expand . . . as populations grow . . . as people live better, oil must provide more energy to power factories, to drive ships and planes and motor vehicles, to heat and light homes and offices. Last year we supplied more than twice the oil we did ten years ago. This year our customers will need still more.

It's a big job . . . and it requires vast amounts of costly equipment. As our Annual Report points out, we spent $1,083,000,000 last year searching for oil and gas and paying for such things as tankers, pipelines and refineries. And in 1957, we plan to spend another $1,250,000,000 to find, produce and deliver the oil people will be needing tomorrow...and ten and twenty years from now.

Because Jersey Standard is willing and able to make such investments and because our operations are efficient, we make a profit. In 1956 it was $808,535,000. About half of it went back into the business to help pay for the new facilities.

Our successful year was good news for the 403,000 shareholders who own the company . . . they got dividends of $2.10 per share on the money they invested.

It was good news for our 156,000 employees . . . whose wages and benefits came to $906,000,000.

It was good news for governments. Operating and income taxes, import duties, consumer taxes and other payments from our operations brought to the United States and other governments a record $2,171,000,000. That was five times the dividends to shareholders, more than double the payroll and benefits to employees.

Best of all, our operations were good news for the people of the free world, who rely heavily on the energy of oil for their economic and social progress.

In this, our 75th anniversary year, we intend to continue our efforts to remain successful, profitable and growing, in order to serve people well.

If you would like a copy of our 1956 Annual Report, write us at Room 1626, 30 Rockefeller Plaza, New York 20, N. Y.

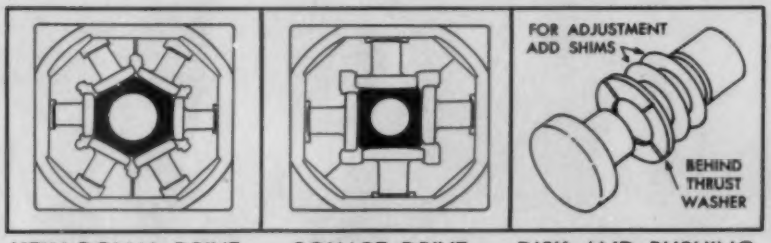
Esso 75 YEARS

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

producing energy for an abundant life

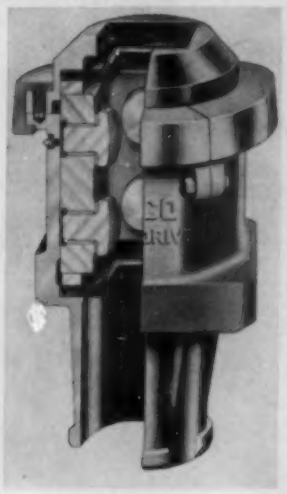
SHOWCASE...

NEW EQUIPMENT



HEXAGONAL DRIVE SQUARE DRIVE DISK AND BUSHING

Rolling-Disk Kelly Drive Now Available



After more than a year of extensive field tests, this new Ideco kelly drive employing rolling disks as bearings is available. A primary advantage of the new design, according to the maker, is the tendency to smooth up and keep flat the driving surfaces of the kelly to assure smooth feedoff and long kelly life.

Because of the shape of the disks there is a large circular area of contact with the kelly, rather than a tangent line of contact as in conventional roller type of kelly drives. The disks are positioned slightly off center from the centerline of the kelly. Thus, they rotate with a wiping action as the kelly is lowered.

Without changing the kelly-drive body, the operator may accommodate various sizes of square or hexagonal kellys merely by changing inserts conveniently on the rig floor, without special tools.

Specially compounded retainers at the top and bottom permit packing the operating mechanism with grease from one lubrication point. An integral tapered pilot tube automatically centers the drive bushing with the table opening, resulting in fast and safe engagement of the two members. **Write or call: Ideco, one of the Dresser Industries, P. O. Box 1331, Dallas, Tex., for details on rolling-disk kelly drive.**

●

New Steel Building Offers Variety of Uses

Developed for use on the lease, at refineries and petrochemical plants, and for general warehousing, this new prefabricated-steel truss type of building with panel sidewalls and ends is available in a variety of standard sizes and styles in regular increments up to 100 ft. in width, 20 ft. in height, and unlimited lengths.

The building is available with industrial windows, doors, translucent roof panels, insulation, guttering, ventilators, and louvers. Partitions, cranes, and monorails also are available. **Write or call: Black, Sivalls & Bryson, Inc., Product Information Dept., 7500 East Twelfth Street, Kansas City 26, Mo., for details on Perfection buildings.**

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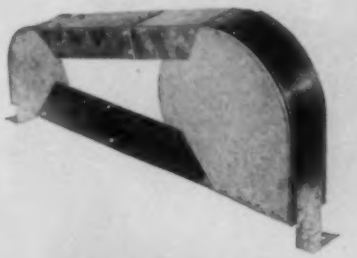


Adjustable Belt Guard Is Easily Assembled

Composed of seven parts, this Bos-Co. Universal Belt Guard can be assembled in the field easily. The guard is universal in that parts of 11 differ-

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS JOURNAL - Issue of June 10, 1957

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

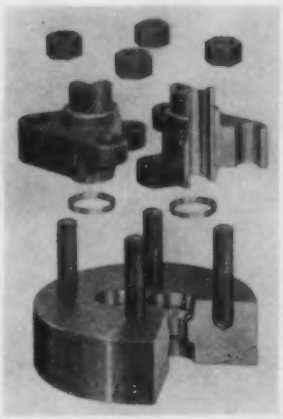
CITY.....STATE.....

DATE.....

New Equipment

ent combinations cover all sheave sizes from 3 to 48 in., widths from 1-A to 6-D grooves, and belt centers from 12 to 130 in.

The guard is said to be lighter than present tailormade conventional types of guards. It usually can be handled by one man. **Write or call: Bos-Co Equipment Engineering & Mfg. 526 South Boulder, Tulsa, Okla., for details on Universal Belt Guard.**



Dual-Completion Flange Strengthens Christmas Trees

With this new Delta flange it is possible to increase the strength of dual-completion christmas trees and decrease maintenance problems, according to the maker. The flange is designed to solve the problem caused by unbalanced flanges that tend to "Y" out under pressure, aggravating leakage problems and sometimes necessitating extra bracing to hold dual strings together.

The flange is said to be unusually strong, because each half is supported in balance by three equally spaced studs and nuts. It can serve as a foundation for threaded or threaded-and-welded christmas-tree assemblies.

The flange is available in 1½, 1¾, and 2-in. sizes in 4,000 and 6,000-lb. test pressures. **Write or call: Oil Center Tool Co., 1912 Airline Drive, Houston, Tex., for details on Delta flange.**

200 GAS WELLS PROTECTED FROM CASING CORROSION

Problem. To protect the casing in more than 200 gas wells from external corrosion. These wells are in the Kansas section of the Hugoton gas field, and are operated by four companies. Six of the wells are in the sand hills area where soil resistivities are of the order of 20,000 ohm-cms.

Solution: CSI engineers made current requirement tests, and then applied cathodic protection using Galvomags—Dow's high-potential magnesium anodes.

Installations were designed to provide a guaranteed current output, with a minimum protection of 10 years. Current requirements ranged from 0.43 to 2.05 amperes. Costs averaged about $325 per well.

For expert consultation, engineering services or cathodic protection materials, call or write today. Estimates or quotations without obligation.

CSI

CORROSION SERVICES INCORPORATED

Tulsa, Oklahoma

P. O. Box 7343, Dept. J10 **Telephone: Circle 5-1351**

Positive-Volume Meter May Eliminate Level Controls

On this new position-volume type of liquid-metering vessel the discharge is registered on a pneumatically operated counter. The Model 26 IM unit has a capacity of 1 bbl. per liquid cycle and operates at a working pressure of 150 psi. Special models are available with working pressures up to 1,200 psi.

According to company officials, the vessel is specifically designed for field use to afford accurate metering of oil and water from either separators or treaters. It eliminates the need for liquid-level controls or dump valves on vessels to which it is connected.

The oil-and-water emulsion flows by gravity into the liquid meter through the inlet port of a 2-in., three-way valve. When the emulsion reaches a predetermined level, the inlet port closes, the outlet port opens, and a precise volume of oil is discharged into

a stock tank. Each discharge is registered automatically on the pneumatically operated counter.

The vessel weighs 294 lb., is 32 in. high, and has a 26-in. i.d. Standard equipment includes tubing and fittings for a complete hookup, a level-switch assembly, a 2-in. three-way valve, control-gas regulator, pneumatic-counter assembly, pressure gage, and gage-glass assembly. **Write or call: Delta Tank Mfg. Co., Inc., Baton Rouge, La., for details on Model 26 IM metering vessel.**

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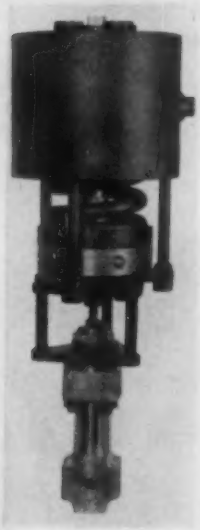


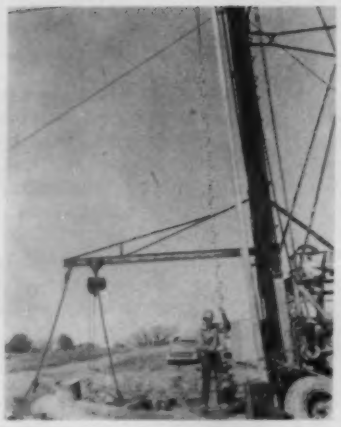
All-Metal Valve Actuators Built for Extreme Conditions

Here's an all-metal actuator for control valves for use under such difficult conditions as high temperature and corrosion.

The all-metal actuator, designed for both pneumatic and hydraulic control systems, is available with suitable valves as a complete control unit, or as an addition to existing valve installations. Some models are designed to function either air-to-open or air-to-close apd are easily reversible in the field.

For use in highly corrosive atmospheres, one model is manufactured with stainless-steel bellows and stem. Its frame is made from cold-rolled steel which has been cadmium plated. It is available in three ranges.

Developing a maximum thrust of about 3,000 lb., the actuator is compact in size, measuring 17⅞ in. long and 8⅝ in. in diameter. One unit, available in an air-to-close type only, is fabricated completely of stainless steel. **Write or call: Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville 1, Tenn., for details on all-metal valve actuators.**



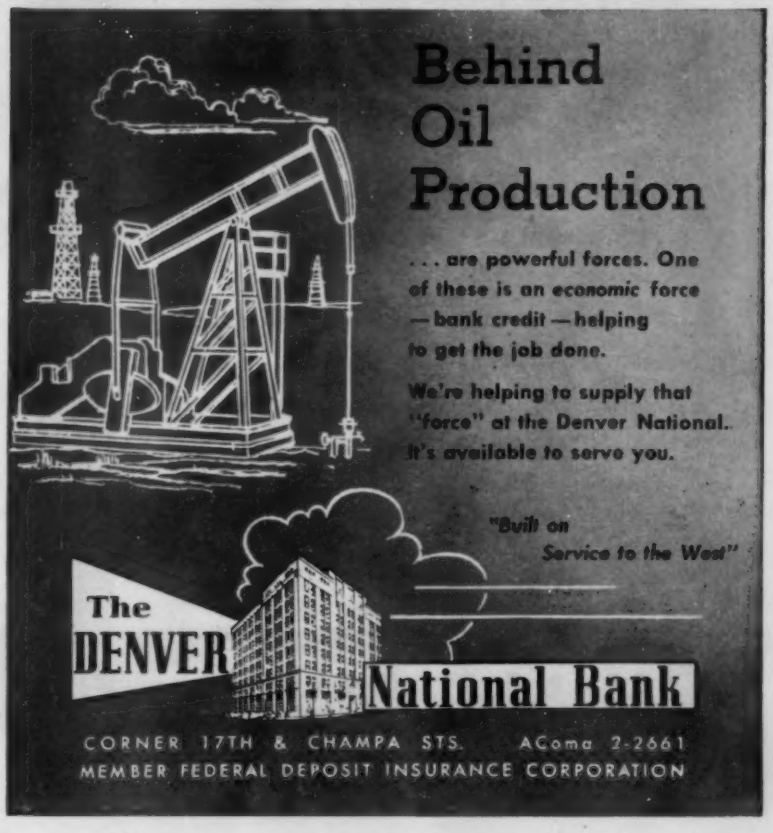
Casing Perforators May Increase Perforation

Now available for use in completing oil and gas wells are these Birdwell Selecto-Jets, expendable perforators of well casing for combined use with a gamma-ray probe. Features cited for the perforating equipment include: (1) better penetration and less burr in the casing because of the use of larger charges at a controllable standoff distance in the smallest or largest casing, (2) more favorable positioning of charges to correspond with indicated pay zones, and (3) a minimum of debris left in the well.

The Selecto-Jets are individual explosive charges housed in pressure-sealed aluminum cases. They are fastened rigidly on a single ⅜-in. aluminum tube of any length up to 50 ft. or more in which there is a primer cord.

They are arranged in any pattern, including blankedout sections, and can be rearranged on location, if necessary,

"Yes suh, since 1933...Quality Batteries by the South's largest, I SAY THE LARGEST, Independent Battery Manufacturer"
Southland
Colonel Southland
SOUTHLAND BATTERY CO.
2040 Amelia • Dallas, Texas
"Custom-built for the South"


Behind Oil Production
. . . are powerful forces. One of these is an economic force — bank credit — helping to get the job done.
We're helping to supply that "force" at the Denver National. It's available to serve you.
"Built on Service to the West"
The DENVER National Bank
CORNER 17TH & CHAMPA STS. AComa 2-2661
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

New Equipment

to correspond with indicated producing zones. As many as 100 or more charges can be shot on one trip down a well.

Use of the Selecto-Jets is commonly guided by previously completed electric logs which are correlated with the gamma-ray log produced by the probe carried with the explosive, thus reportedly making perforations at pay zones a precision job, especially valuable when a pay zone is small. **Write or call: Birdwell, Inc., Bradford, Pa., for details on Selecto-Jets.**

Gas Detector Warns of Excessive Accumulations

Warning against excessive accumulations of harmful gases in boats and plants is given by this Atlas permanent gas detector. The Model 520 unit is designed for permanent installation. Its panel may be large or small to suit the location.

A loud, outside warning alarm may be incorporated in the detector. Or, it may be designed to open or close valves, turn on fans, open doors, or operate other electrically controlled devices.

It consists of an instrument control

board and detector stations connected to the control board with three-wire conductor cable. The main panel may be situated near a telephone switchboard or in a control room. **Write or call: Atlas Laboratories, Inc., 1911 West Alabama, P. O. Box 6247, Houston 6, Tex., for details on gas detector.**

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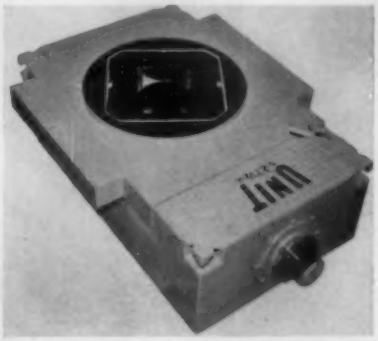
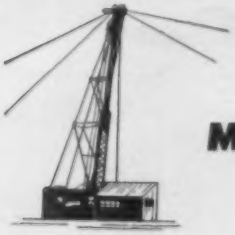


Rotary Table Designed For Fast Handling

On this new 27½-in. rotary table, triple labyrinth mud-seal and flinger rings are used to make the table mud-proof, the maker reports. Handling lugs designed with open ends permit quick handling. Also, the table's rectangular lines permit quick and easy flooring buildup.

A locking device, working on the perimeter of the table, is said to eliminate all shock loads from the gear and pinion. Of a spiral bevel type, the gears are lapped and matched for smooth performance and hardened to provide long life. The master bushing is locked in place with a single lock, operated from the top of the table.

The heavy-duty main bearings consist of thirty-two 3-in. balls, accurately matched for proper load distribution. The gear and pinion, inboard pinion-shaft bearing, and the main load bearings are all oil lubricated. Both the outboard pinion shaft and the stabilizing bearing are grease lubricated. For quick change or replacement, the rotary sprocket uses a bolton type of hub. Available table openings are: 17½, 21,



SPANG

MOLLOY BITS *are*

Superior

THE PROOF IS IN THE DRILLING. Think about this. Actual performance records compiled by drillers everywhere testify to the superiority of Spang Molloy Bits. Known results prove these completely heat-treated high molybdenum silicon alloy steel bits drill faster at lower cost in the hardest and/or most irregular formations. Its stronger blade section and greater pin strength enables the Spang Molloy Bit to overcome the abrasion and battering which causes ordinary bits to fail.

Play it smart and beat your tough drilling problems with Spang Molloy Bits!

SPANG & COMPANY

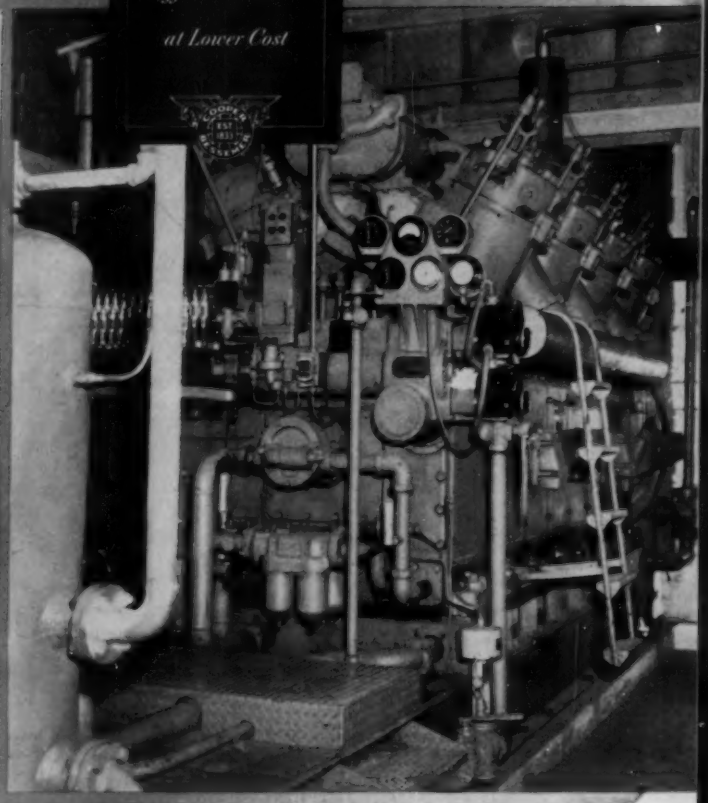
DEPT. O-1 BUTLER, PENNSYLVANIA

For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Water Wells, Prospect Drilling and Shot Blast Holes.

One of three packaged GMXA's in the Eunice, New Mexico, station of United Carbon. These units, rated 550 hp at 450 rpm, efficiently compress a sour casinghead gas.

This view of the Eunice Station shows one of the 8-cylinder Cooper-Bessemers in place, while construction continues on the framework of the compressor building.

Another Example of Efficient Power at Lower Cost



How UNITED CARBON sets a new LOW in compressor station costs with PACKAGED COOPER-BESSEMERS

Here are details on "big savings" in United Carbon Company's Eunice, New Mexico, natural gas plant. Three Cooper-Bessemer GMXA compressors, completely packaged, provide exceptional installation economies due to pre-assembly of the following:

1. The entire cooling system.
2. The entire lube oil system.
3. The entire fuel system.
4. The entire starting air system.
5. Entire gas piping to point of inlet and outlet.
6. Elimination of costly piping and design work usually necessary in this type of installation.
7. A simple, inexpensive mat type foundation to accommodate the skid-mounted GMXA compressor.

. . . . seven good reasons that help explain why the Eunice Station *cost less to build* than any of United Carbon's previous compressor installations.

If you have been searching for ways to cut costs . . . . yet maintain compressor dependability, availability, flexibility . . . you'll want to learn more about the latest advancements now being offered by one of the nation's oldest engine and compressor builders . . . Cooper-Bessemer. Contact the nearest office listed below for complete information.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Chicago, Ill. • Houston, Dallas, Greggton, Pampa and Odessa, Texas • Washington, D. C. Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. Caracas, Venezuela • COOPER-BESSEMER OF CANADA, LTD., Edmonton and Calgary, Alberta, Canada.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

SHOWCASE . . .

New Equipment

and 27½-in. with 44-in. (short) and 53¼-in. (long) center-line-sprocket to center-line-well pinion shafts. **Write or call: Unit Rig & Equipment Co., P. O. Box 1889, Tulsa 1, Okla., for details on 27½-in. rotary table.**

Recording Gages Available In Weatherproofing Case

Now Bristol recording gages for pressure, vacuum, and water or liquid level measurements are available in this new weatherproof case.

The case is designed for wall or pole mounting outdoors, where it will be subjected to all types of weather. Measurements of the depth of water or other liquids can be accomplished with float, pressure, differential-pressure, or bubbler types of liquid-level gages.

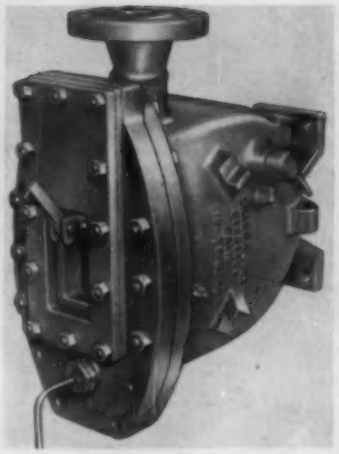
Both 8 and 12-in. round-chart recording gages are available in the new case. Flowmeters and thermometers also are available. **Write or call: Bristol Co., Waterbury 20, Conn., for Bulletin L701.**

•

Automatic Tank Gage Measures at 150 to 300 Psi.

Here is a new automatic tank gage for measuring products under pressures from 150 to 300 psi. The gage incorporates a Neg'ator motor, a constant torque spring that exerts a restraining force which does not increase as the elastic member is extended, thus giving consistent tape readings regardless of the position of the float. In addition to providing accuracy, the design also eliminates the conventional counterweight, with its supporting tape and housing, according to the maker.

According to Shand & Jurs Co., this new gage is said to bring new accuracy and safety to gaging tanks in which hand gaging is impossible and where gage glasses often are inaccurate.



The assembly includes a Type 18-8 stainless-steel tape, graduated in eighths of an inch, and a tubing aluminum pressure float as standard equipment. A stainless-steel float is optional equipment. Identified as Model ST-9400, the gage is available for both ground and roof reading. **Write or call: Shand & Jurs Co., 110 East Forty-Second Street, New York 17, for details on Model ST-9400 tank gage.**

M. O. Johnston
Johnston Testers, says:

"HERE'S REAL HUNTING!"

Right! You can take it from "M. O.", if you want

ELK, BEAR, DEER, ANTELOPE
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then let us arrange all details of your next trip. Good selection of excellent accommodations. Stag or family.

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Thinking of a fine rifle made "just for you?" Let us tell you about Frank Arra's Custom jobs. They're terrific!

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For Cathodic Protection.. only ZINC ANODES

Have Long Life and are Self-Regulating

Unlike other metals sometimes used for cathodic protection, zinc anodes have an expected life of a minimum of fifteen years. Zinc anodes are self-regulating and require no current regulating resistors to meet the load demand, whether high or low.

These are important reasons why American Zinc Anodes are first choice for cathodic protection in the oil and gas industry. Your inquiries invited.

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SHOWCASE . . .

New Literature

Corrosion-Resistant Pipe Fittings available in stainless-steel Types 304, 304L, 316, 316L, and Carpenter 20 are set forth in this new 24-page brochure. The fittings are designed to permit process engineers to take advantage of new Schedules 5 and 10 pipe. According to the brochure, the fittings allow the pipe designer a multiple choice of making butt-welded, expanded-and-flanged, or socket-type joints on most any installation. The brochure furnishes available sizes, schedule numbers, and complete dimensions for the fittings. It also furnishes information on a heat exchanger incorporating a modified Speedline insert flange. **Write or call: Horace T. Potts Co., 504 Erie Avenue, Philadelphia 34, Pa., for Speedline Fittings brochure.**

●

Vertical Industrial Pumps for a variety of petroleum-industry uses are described in this series of three four-page folders. The Type A pump utilizes a cast discharge head and standard 125-lb. A.S.A. discharge flange. It provides heads to 400 ft. and capacities to 12,000 g.p.m. at temperatures to 250° F. The Type B pump comes with either a cast or a fabricated discharge head. It has a standard A.S.A. flange mount and discharge with below-base suction and above-base discharge. It provides heads up to 1,200 ft. and capacities to 12,000 ft. per minute at temperatures to 600° F. The Type C pump utilizes a discharge head of fabricated construction with in-line suction and discharge flanges. It provides heads to 1,200 ft. and capacities to 12,000 g.p.m. also at temperatures to 600° F. **Write or call: Johnston Pump Co., Bin K, Pasadena, Calif., for folders on Types A, B, and C pumps.**

●

New Automatic Pumper that automatically shuts down a well when it is pumped off and automatically starts it again at any predetermined time is the subject of this new four-page brochure. Closeup photographs show how the pumper works. A schematic diagram and text furnish both electrical and mechanical installation instructions. **Write or call: Baird Mfg. Co., Box 380, Tulsa, Okla., for brochure on automatic pumper.**

●

Drilling Mud Surfactant and a drilling-mud emulsifier are described in this new 10-page bulletin, labeled DMS-

you never see a repair tag on this one!
This Ampco centrifugal is being used as a charging pump handling treated water in a California oilfield.
It's an AMPCO
Centrifugal Pump
To protect you against pump failures under corrosive and erosive conditions, Ampco gives you protective features other standard pumps don't have. These Ampco extras include:
Wear rings—to save the casing, prevent expensive repairs, reduce down-time.
Shaft sleeves—to give greater operating economy, eliminate worn shafts, cut maintenance costs.
With all their special-pump advantages, Ampco Pumps sell at standard-pump prices.
That's just part of the Ampco story. Send coupon for Bulletin P-3b and all the facts on Ampco Centrifugal Pumps in aluminum bronze, stainless steel, or other workable alloys.
Speeds, 1750 — 3500 rpm Capacities to 600 gpm. Heads to 300 feet
AMPCO
THE METAL WITHOUT AN EQUAL

AMPCO METAL, INC., Dept. OGJ-6, Milwaukee 46, Wisconsin
West Coast Plant: Burbank, California

AMPCO METAL, INC.
Dept. OGJ-6
Milwaukee 46, Wis.

Send me Bulletin P-3b

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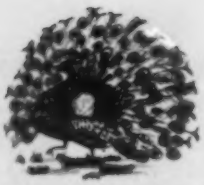
P-29

UNITED SUPPLY IS PROUD



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SERVICE

AT ANY **UNITED SUPPLY**

STORE

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OR

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IS BEYOND THE

REACH OF YOUR **UNITED SUPPLY**

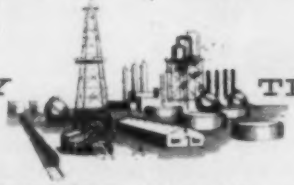
MAN

.. AND HE ALWAYS GETS

THERE IN A HURRY

IN THE OIL

COUNTRY



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AND *Manufacturing* COMPANY

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DME. The surfactant is a concentrated aqueous solution of a nonionic surfactant and an optimum proportion of defoamant. The emulsifier is a concentrated aqueous solution of a nonionic emulsifier that is said to cause a stable emulsion to form when oil is added to a water-base drilling mud. The bulletin explains how the materials are applied, their advantages, and handling procedures. **Write or call: Baroid Div., National Lead Co., P. O. Box 1675, Houston 1, Tex., for DMS-DME bulletin.**

●

Antennas, Antenna Systems and Microwave Transmission Lines are explained and pictured in new 32-page Catalog Supplement 21-S. It furnishes specifications and mounting and adjustment data on parabolic, directional gain, and unipole antennas. The catalog also gives the characteristics, and construction features of semiflexible cable, fittings, transmission lines and accessories. The back of the catalog includes a price list and ordering information. **Write or call: Andrew Corp., 363 East Seventy-Fifth Street, Chicago 19, Ill., for Catalog Supplement 21-S.**

●

Pinch Type of Valves for handling abrasives, corrosives, and slurries are explained and illustrated in new 48-page Catalog FL-1116. Indexed for ready reference, it furnishes cutaway illustrations, schematic diagrams, specification, and dimension tables. It also contains a useful data section on how to size, install, maintain, and mount the valves. Too, the catalog includes a corrosion guide for selecting the right valve diaphragm for various media. **Write or call: Farris Flexible Valve Corp., 400 Commercial Avenue, Palisades Park, N. J., for Catalog FL-1116.**

●

Weather-Protected Motors in ratings from 250 to 900 hp. are described in new Bulletin 51 B8606A. Built to meet defined N.E.M.A. requirements, the motors feature: (1) a sturdy steel frame, (2) removable prewound stator assembly, (3) capsule-mounted split-sleeve bearings, (4) removable air ducts, and (5) protective screens. **Write or call: Allis-Chalmers Mfg. Co., P. O. Box 512, Milwaukee, Wis., for Bulletin 51 B8606A.**

●

Temperature and Pressure Controls are the subject of this new 96-page industrial catalog. It describes more than 34 basic types, including self-operating regulators, water-mixing equipment, pneumatic control instruments, indi-

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

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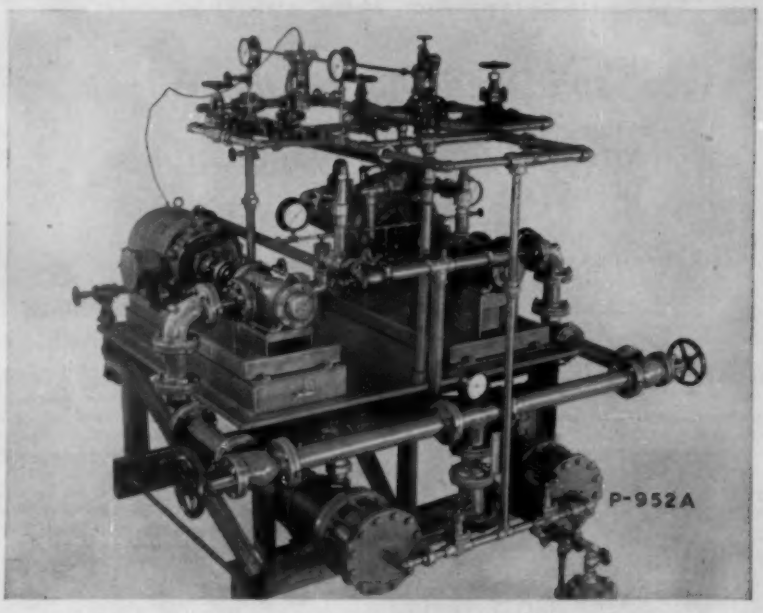

P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-E52H size No. 25 unit.

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XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

cating and recording instruments, control valves, and pneumatic motors. This spiral-bound catalog furnishes construction, application, and installation data along with diagrams and cutaway views of the controls. **Write or call: Powers Regulator Co., 3434 Oakton Street, Skokie, Ill., for copy of controls catalog.**

•

High-Pressure Gas-Regulator Bulletin 1024-6, a newly revised eight-page publication, describes the complete line of Rockwell high-pressure regulators. The bulletin includes a description, photos, and drawings of a high-pressure regulator which will withstand momentary overloads as high as 1,000 psi. on the outlet side without damage to the regulator. The bulletin also includes complete capacity tables on the regulators. **Write or call: Meter and Valve Div., Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, Pa., for Bulletin 1024-6.**

•

Impulse Steam Traps for handling heavy condensate loads and available in sizes from ½ through 2½ in. for working steam pressures up to 600 psi. at a maximum temperature of 750° F. are fully described and illustrated in Bulletin T-1746. The four-page bulletin describes the operation of the traps, gives available sizes and capacities, lists typical applications, and shows dimensions, weights, and prices. **Write or call: Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, Pa., for Bulletin T-1746.**

•

Gas Regulators for house or service installation are pictured and illustrated in Bulletin 100. The new bulletin gives complete details on 36 different regulator models available both with and without meter bars. It furnishes information on construction, capacities, dimensions, standard modifications, and replacement parts. **Write or call: American Meter Co., Erie, Pa., for Bulletin 100.**

•

Drill Pipe and Tool Joints along with a new type of hardfacing for Spang tool joints are described in new Bulletin 463. It includes details on hardfacing specifications and application methods. In addition to complete specifications on tool joints for drill pipe, the bulletin covers tubing tool joints and gives 21 suggestions for the care and maintenance of all kinds of tool joints. **Write or call: National Supply Co., 2 Gateway Center, Pittsburgh, Pa., for Bulletin 463.**

EQUIPMENT MEN . . . in the News

American Iron's Shirley, Taylor Make Trip to Italy

J. M. Taylor, New York City, export manager, and Leroy Shirley, Oklahoma City, both of American Iron & Machine Works Co., Inc., have recently left for Milan, Italy.

Shirley will make the final check of the tool-joint manufacturing plant of Breda-Fucine, whom American Iron has licensed to manufacture the Straight Grip tool joint. He will approve all tooling, gaging, and engineering specifications of this product.

Taylor will make business contacts in Italy and other European countries relative to American Iron oil-field drilling products.

Cameron Iron Promotes Blackledge and Brougher

Allan D. Blackledge was promoted from manager of the special products

BLACKLEDGE

J. W. BROUGHER

department to assistant manager of the company. J. W. Brougher was named new manager of the special products department.

Blackledge came to Cameron in 1950 as manager of the ordnance division. Brougher joined Cameron in 1954 and in 1955 he was advanced to chief of estimating and pricing.

Foxboro Co. to Add New Factory, Office Building

Construction will start in July on a new addition to The Foxboro Co.'s instrument manufacturing plant at Foxboro, Mass. The new structure, adjoining the present instrument assembly building, will expand production capacity 50 per cent. Completion is scheduled for the summer of 1958.

Of one-story construction, the new factory building will be 475 ft. by 250 ft. and will house a receiving department and all machining and finishing operations. Fronting this area will be a two-story office building, 300 ft. by 50 ft. Storage facilities will be provided by a new warehouse adjoining the factory addition. With the 175,000 sq. ft. added by this new construction, the firm will have 475,000 sq. ft. of manufacturing space, putting most of the manufacturing activity in one-story quarters.

Waukesha Holds Sales Meeting in Houston

Sales representatives of Waukesha Sales & Service, Inc., Houston, and officials of Waukesha Motor Co., Waukesha, Wis., recently held a 2-day meeting in Houston. Waukesha is distributor in Texas, Louisiana and part of New Mexico for all types of Waukesha engines, including a new marine diesel line, and recently has added the Flo-Way turbine pump and American M.A.R.C. diesels.

Shown are E. R. Rutenber, chief installation engineer for Waukesha Motor Co.; J. L. Kluppel, service manager, Waukesha Sales & Service; L. M. Pearce, Jr., president, Waukesha Sales & Service; F. C. Schulze, sales manager, Waukesha Motor Co.; and Charley Zagst, sales manager, Waukesha Sales & Service.

National Ships Big Pump To Iran's Qum Area

This National G-1000 slush pump, with three-engine drive group and three torque-converter-equipped engines mounted on the same special base, is shown as it was rigged up at a National Supply Co. plant for testing prior to shipment to Iran. The Iran Oil Co. will use it in the Qum area in conjunction with either a Type 80-B or a Type 100 National rig. The big pump and its power equipment will be set up about 100 yards from the drilling rig and will have its own mud pits so that it will be available for protection in case of blowout of a well.

Oilwell Promotes Reid to Ass't. District Manager

J. M. REID

The promotion of James M. Reid to assistant district manager, Oklahoma district, of United States Steel Corp.'s Oil Well Supply Division has been announced by Mark Barkhurst, manager of Oilwell's Mid-Continent area.

Reid has served as manager of the Oilwell store at Duncan since 1953. In his new position he will be concerned with operations of the division's stores in southern Oklahoma and will continue to headquarter at Duncan.

He joined Oilwell in 1946 at Oklahoma City. He subsequently served as field representative at Cushing and as manager of stores at Elk City and Healdton. He became district representative at Ardmore in 1952 and of the Duncan store in 1953.

Beacon Supply Adds Martin And Lewis to Sales Force

The addition of (J) Shan Martin and Victor L. Lewis to the sales force of Beacon Supply Co., Pampa, Tex., has been announced by R. W. Sidwell, vice president. Martin, who will manage the Dallas district sales office, for the

Arnold Lewis says..."When it comes to Slim Hole Drilling...

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THESE FEATURES MAKE THE DIFFERENCE!

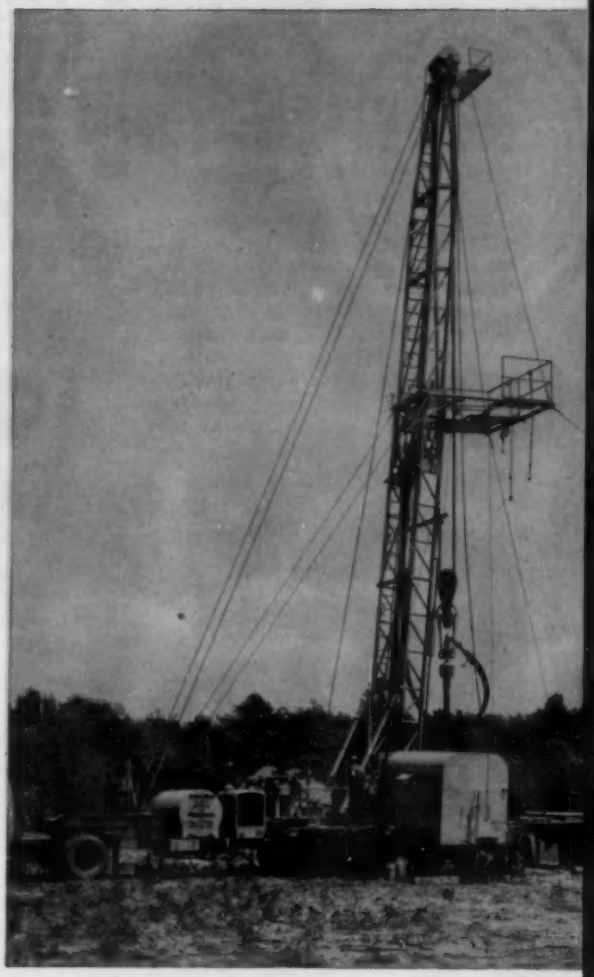
- Power take-off chain oil bath lubricated.
- Self-supporting mast under normal loads.
- Mast hydraulically raised, mechanically telescoped, 4 legs – in either truck or trailer mounted arrangement.
- Air compressor with complete air system and controls for drum clutches, engine clutch, and rotary drive clutch.
- Driller's position is forward . . . near the well and located at platform height for complete visibility and better access to derrick floor.

Three Man Crew"

Using a completely portable Cardwell Model AL rotary rig, equipped with a Cardwell Model 100 mast, Arnold L. Lewis – doing business as Lewis Drilling Company out of Princeton, Indiana – has found "reduced manpower . . . drilling equipment . . . and hole size makes Slim Hole Drilling with Cardwell equipment the most economical and efficient method for both producer and drilling contractor."

This Cardwell rig is handled very efficiently and economically by a three-man crew. Not only is there a decided saving in drilling and completion costs, but moving, rig-up and tear-down time are saved – adding to the efficiency of this type of Slim Hole drilling.

Cardwell's Model AL, a single-engine, mechanical-driven hoist, has a Slim Hole depth rating of 4,000 feet using 2⅞ inch drill pipe. For rotary drilling, depth rating is 2,000 feet with 4½ inch drill pipe or 2,500 feet with 3½ inch drill pipe. In servicing or rotary workover, the rating is 5,000 feet. Nominal input rating of the Model AL is 120 horsepower. New alloy steels make the unit tougher . . . but lighter. It is specifically designed to combine fast operating speeds with extreme portability.



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past 6 years has been with Continental-Emsco Co.

Lewis will be sales representative at the Tulsa district sales office. For the past 12 years he has been sales representative for the D+B division of Continental-Emsco and has been located at several points in Kansas, Oklahoma, and West Texas.

Le Roi Names Permar Ass't. General Sales Manager

DON S. PERMAR

Don S. Permar has been named to the newly created position of assistant general sales manager for the Le Roi division, Westinghouse Air Brake Co., Milwaukee, Wis., according to Jack E. Heuser, general sales manager for Le Roi.

Permar has been field sales manager for Le Roi since 1954. Prior to that time, he was sales manager of stationary air compressors. Permar joined Westinghouse Air Brake Co. as a pneumatic engineer in 1945 and came to the Le Roi division in 1954. Permar will continue to be responsible for the operation of the field sales staff. His new work will increase his activities and responsibilities in all operations of the sales department.

Cooper-Bessemer Names Tulsa Branch Manager

A. ABEL, JR.

The appointment of Arthur Abel, Jr. as district manager of Cooper-Bessemer Corp.'s Tulsa office has been announced by Stanley E. Johnson, vice president and director of sales. Formerly branch manager of the company's Odessa, Tex., office, Abel will now head all field sales and engineering activities in the Tulsa area. He fills the position formerly held by B. L. Potter, who has retired.

Abel went to Cooper-Bessemer in 1940, was assigned to the Los Angeles office as sales engineer in 1944, and became branch manager at Odessa in 1945.

Potter recently completed his forty-fourth year with the engine building industry. He was branch manager of the Tulsa office and in 1947 was elected vice president and Mid-Continent manager.

Halliburton Logging Operators Train at 7-Week School

A 7-week Halliburton electrical well service operators school was recently held at Halliburton Oil Well Cementing Co.'s EWS laboratories in Houston. The following EWS personnel attended: (front row): N. L. Stegall, operator, Tyler; A. H. Smith, engineer, Mission; N. A. Miller, operator, New Orleans; C. L. Morris, operator, Norwalk; E. R. Smith, trainee, Houma; C. D. Landry, operator, Houston; F. N. Liscum, division engineer, Shreveport.

Back row: G. A. Fowler, operator, Canada; C. F. London, engineer, Alice; B. B. White, driver, Pampa; L. G. Moffatt, assistant division engineer, Dallas; E. D. Jalufka, trainee, Houston; W. D. Hearn, district engineer, Cushing; H. J. Ayres, fracturing, Duncan; and J. L. Tyson, district engineer, Oklahoma City.

Not shown in the picture but attending the 2-week interpretation section was M. C. Davis, engineer, Houston EWS research laboratory.

Allen, Broxham Advanced By Graver Tank & Mfg.

The advancement of S. E. Allen to vice president and general manager of all company operations and W. M. Broxham to vice president and general manager of the plate and alloy products division has been announced by J. E. Swanson, president of Graver Tank & Manufacturing Co., Inc., East Chicago, Ind.

S. E. ALLEN

W. M. BROXHAM

Allen was formerly general manager of plate products. He now will supervise all parent company plants, as well as Graver Water Conditioning Co., the Graver Mid-Continent division, and Graver Construction Co., Inc., all Graver subsidiaries.

Prior to joining Graver 3 years ago, Allen had been vice president in charge of manufacturing for Pusey & Jones and served as a foundry and machine consultant for American Locomotive Co., following 17 years as president of his own company specializing in foundry and machine work.

Broxham was formerly vice president-sales, of all Graver operations. Affiliated with Graver for over 30 years, he has served as a sales engineer, manager of the Philadelphia office and sales manager of plate products. In 1952 he was named vice president-sales, for all Graver companies.

Coreco Protects Kansas Wells Against Corrosion

Corrosion Rectifying Co., Inc., Houston, has recently completed systems for corrosion prevention on some 100 wells in the central and southwest Kansas oil-producing areas. Approximately 30 of these wells are operated by Kewanee Oil Co.

These systems use both graphite anodes in conjunction with specially designed well-head generating equipment and magnesium anodes. The installations were made under the direction of Coreco's Great Bend, Kans., office, Harvey Fanshier, engineer in charge of the projects.

Line Scale Elects Executive Vice President

P. GRANDSTAFF

The election of Perry Grandstaff as executive vice president, Line Scale Co., Inc., Oklahoma City, has been announced by M. G. McCool, president. Formerly general manager, Grandstaff started with Lane Scale Co. as chief engineer.

Other officers of the corporation are: C. O. Morehead, vice president; Mrs. Helen G. Mitchell, secretary and assistant treasurer; M. G. McCool, president, treasurer and chairman of the board.

Milton Roy Promotes Procopi and Smith

John Propcopi has been appointed sales manager and H. Rodman Smith assistant sales manager for Milton Roy Co., Philadelphia. Procopi will be responsible for marketing activities, reporting to W. T. Griffiths, vice president of marketing. Smith will direct several phases of the company's

JOHN PROCOPI

H. R. SMITH

marketing activities including order service and market development.

For the past 4 years Procopi has been manager of market development. Previously he was in advertising and sales promotional work for Minneapolis-Honeywell Regulator Co. Smith joined Milton Roy 5 years ago as an application engineer and was later promoted to chief application engineer.

Charles Wheatley Appoints Burtner as Area Sales Mgr.

H. E. (Gene) Burtner has been appointed as a new area sales manager for Charles Wheatley Co., manufacturers of Stream-Flo valves. Burtner will headquarter in Lafayette, La., and will be in charge of sales in Louisiana, Arkansas, Mississippi, Alabama, Georgia and Florida.

Burtner has had 25 years experience selling oil-field specialties in the Mid-Continent oil field. He was formerly a salesman of coatings for underground pipeline construction for several major pipeline companies. He has also been associated with E. W. Robinson Supply Co., M. J. Crose Manufacturing Co., Gustin-Bacon Manufacturing Co., and for 2 years was a pump salesman for Charles Wheatley Co.

Juett Appointed Goodyear Petroleum Representative

William C. Juett, for more than 13 years a member of the sales organization of the Goodyear Tire & Rubber Co., has been appointed special petroleum representative in the Southwest region, with headquarters in Dallas, it has been announced by O. E. Miles, sales manager.

Juett served Goodyear as Houston district salesman, service representative, and field representative.

Petroleum Specialty Acquires Paramount Stock

A. E. Hickman, president, Petroleum Specialty Co., Inc., manufacturers of Crall spiral paraffin scrapers, has announced the purchase of all outstanding shares in Paramount Equipment Co., Inc., Tulsa, oil-field manufacturers of polished rod clamps, portable rod hangers, rod line weights, safety sub-elevators and other production equipment.

R. W. Sheridan, stockholder in Paramount Equipment, is now connected with Petroleum Specialty and will remain at the Tulsa Paramount plant.

Petroleum Specialty Co. has general offices in Pampa, Tex., general sales offices in Tulsa, and operates throughout the United States and Canada under the direction of Judson A. Wells, general sales manager.

Houdry Makes Personnel Changes in Two Divisions

D. E. Womeldorph and F. R. Walser become commercial development engineers in the sales department of the process sales and engineering division of Houdry Process Corp.

In the sales and engineering division's engineering department, Lee Friedman becomes assistant supervisor-process design; R. G. Craig and A. K. Logwinuk were appointed senior process design engineers, and Bent Busch-Peterson becomes an associate process design engineer. In the same division's technical service department, W. J. Cross was named assistant supervisor.

In the development department of the research division in Linwood, Pa., Kapp became commercial development section chief, and R. E. Ashwill was named chief, chemical engineering section.

Womeldorph has been a senior process design engineer in the engineering department. Walser had been commercial development section chief in the development department, research division.

Otis and Shell Officials Study New Safety-Valve Plans

Reviewing design plans for an improved safety device to be used in a new type of completion for wells in Lake Maracaibo, Venezuela, are these officials of Otis Pressure Control, Inc., Dallas, and Compania Shell de Venezuela: (seated) H. C. Otis, chairman of the board, Otis Pressure Control, and D. M. Koons, production engineer for Compania Shell de Veneznela, Caracas. Standing: Robert H. McLemore, president of Otis; Harold Bradshaw, service specialist for Servicio Technico de Pozos "Otis," C. A., Otis' South American subsidiary; Phil Sizer, Otis design engineer on the valve project; V. R. Cherry, Servicio manager, Caracas; and Lowell Wilhoit, vice president of engineering for Otis.

The special subsurface safety valve allows either tubing or casing flow or gas lift on the tubing or casing. The installation, developed primarily because of heavy barge traffic on Lake Maracaibo, has been installed in more than a hundred wells in the lake area.

Squeezing Burns Up Profits!

The Weatherford Technique helps you avoid squeeze jobs.

Everyone knows that squeeze cementing is costly—both in dollars spent and production time lost. The cost can never be recovered even if the squeeze is successful.

Squeezing can be avoided, however, by securing a good cement job the first time. The Weatherford Technique is the best known method of obtaining a good primary cement job. Considering the major investment required in drilling the well down to the casing point, The Weatherford Technique is mighty low cost insurance.

The Weatherford Technique helps prevent cement channeling and the formation of water voids, by controlling the excess water used in today's cement slurries.

It helps prevent bridging and so-called flash setting, by controlling the floculated mass of mixed mud and cement.

It helps insure a known annulus for the passage of mud and cement all around the casing, through the use of properly spaced centralizers of the correct size and type.

It helps insure a strong bond between cement and formation, by removal of excess wall cake, gelled or viscous mud, and other foreign matter.

Capable, experienced Weatherford engineers will plan your cement job in your best interest.

Take steps to insure a good primary cement job! Call the Weatherford office in your area, or write us for detailed information.

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THE WEATHERFORD TECHNIQUE

Two Strikes Breathe Hope Into Powder River Basin

By Frank J. Gardner

TWO recent strikes in the Powder River basin should encourage deeper wildcatting in its central and eastern portions. Only the southeastern and southwestern flanks have seen any appreciable exploration.

TWO RECENT strikes in the enormous Powder River basin of Wyoming and Montana should serve notice on Rocky Mountain operators that they have lots to hope for in this second largest basin of the United States.

Timid wildcatters . . . Despite the fact that Powder River has been on the producing list since 1889, and that it boasts one of the most prolific oil fields in the U. S. at Salt Creek, wildcatters have been notoriously timid about stepping out into the middle of the big basin to see what's there. Discoveries have been confined to the margins of the basin, mostly on the southwestern and southeastern edges; and the two opposing margins present entirely different structural conditions. Powder River is a structural and topographic basin, asymmetrical, with its deepest portion hugging the mountain ranges to the west; here, the sedimentary section approaches 16,000 ft., and the oil finder looks for faults, folds, and other structural traps. On the east side, the basin is broad and gentle, and the objective heretofore has been the simple strat traps found in Cretaceous sands at shallow depths.

A couple of months ago, the east side of Powder River made headlines when True Oil Co. B-6 Burrows (Section 8-49n-68w) was completed for 672 bbl. a day of 32° oil on ¾-in. choke, with flow coming from the Minnelusa-Pennsylvanian at 7,727-37 ft. This was a deep test in Crook County, Wyoming's, Donkey Creek field, a Dakota-Cretaceous producer at 6,252 ft. Never before had the Pennsylvanian registered such success in eastern Powder River; smaller Pennsylvanian discoveries had occurred 27 miles to the northwest at Adon in 1948, and 23 miles northwest at Mitchell Creek in 1953, where initial potentials were 244 bbl. and 124 bbl., respectively.

At Adon, The Texas Co. completed in Minnelusa at 9,000 ft.; at Mitchell Creek, Trigood Oil Co. and Texaco found Minnelusa flows at 7,650 ft. Adon proved a disappointment, however, and produced only 32,513 bbl., with last production reported in 1951. Mitchell Creek fared no better, with only 1,662 bbl. produced and no report since 1954. It is to be hoped that Donkey Creek will provide the necessary clues to development of sustained deep Pennsylvanian production on this eastern flank of Powder River. A confirmation to the southeast, Texaco 2 Stevenson NCT-2, is being closely watched.

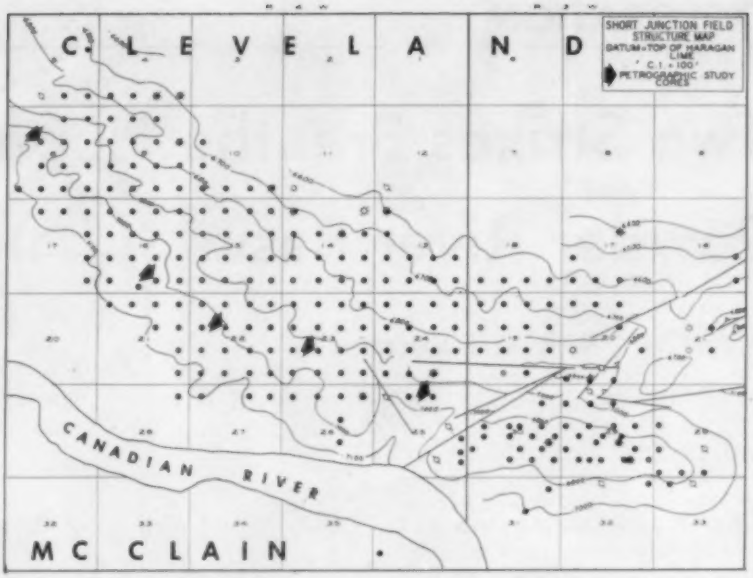
Versus courageous ones . . . Now, a courageous wildcatter has stepped right out into the center of the basin and found Cretaceous-Parkman oil at 7,000 ft.; Farmers Union Central Exchange 1 Ferguson - Government (Section 13-49n-76w) earlier this month reported recovery of 2,955 ft. of clean oil on a 2-hour drill-stem test of Parkman sand at 6,964-7,014 ft. This one is in western Campbell County, 45 miles due west of Donkey Creek, and in truly remote wildcat country. Previous wildcats to the north and east of the discovery had recorded shows and stains in the Parkman. If Farmers Union can make a successful completion here, deep drilling toward the basin center should be vastly encouraged. Operators have not yet run a production test in the discovery zone, but later drill-stem tests in lower zones have been disappointing, and it's likely that completion will be effected at 6,964-7,014 ft.

Only one other discovery has ever been made in the basin "deep;" this was Powell field, opened in January 1954 by Union Oil Co. of California at its 1 Powell Unit. This wildcat, in Section 29-40n-73w, drilled to 11,684 ft., where it was still in Frontier-Cretaceous, plugged back and completed in the Sussex-Cretaceous at 9,600 ft. for only 28 bbl. a day. It has not reported production since discovery.

And complexity vs. simplicity . . . Powder River, with its structural complexities on the west and its stratigraphic simplicities on the east, its multiple pay prospects and varied trap types, has tempted the drill more than any other province of the Rockies. It has blown hot and cold, but consistently has been the most active of the Wyoming basins since 1889. As a rule, however, activity at any one time has been concentrated on one flank or the other, as the herd instinct held full sway over operators. Its deeper and central portions must surely hold many undiscovered pools on broad simple uplifts in rocks of Cretaceous, Pennsylvanian, and Mississippian age. There's still lots to hope for at Powder River.

Part 2

Part 1 of this article was published June 3



SHORT JUNCTION FIELD structure map. Fig. 6.

In Central Oklahoma . . .

Bois d'Arc Pay Spurs

By Ed Barrett and Eugene F. Culp

OIL AND GAS fields which produce from the Bois d'Arc lime in Central Oklahoma may be divided into three classes:

1. Those located along the regional truncation line of the Bois d'Arc lime.
2. Those located downdip from the line of regional truncation.
3. Those located in buried outliers or erosional remnants of Bois d'Arc lime updip from the regional truncation line.

In fields so far discovered, the first group far overshadows the others in size, productivity, and quality of production. There is no reason to believe that Bois d'Arc pools discovered in the future will alter this general pattern. Relative to the infinite variety of geological processes which have formed both the discovered pools as well as those we believe are yet to be discovered, it would be possible to further subdivide at some length each of these broad classes of fields. Here, however, this will be undertaken only to a limited extent.

Fields along the regional truncation line . . . Two fields exemplify the truncation line type of production. These are West Edmond and Short Junction. The former is located along the northwest-southeast regional Bois d'Arc truncation line, but the latter lies southwest of the Oklahoma City uplift in the portion of the regional truncated edge of the Bois d'Arc which encircles the western side of the uplift.

. . . West Edmond oil field stretches for some 20 miles northward from the northwest edge of Oklahoma City and is about 5 miles wide over much of its length. The discovery well, Fox-Schmitz 1 Wagner, NW NW SW 32-14n-4w, was promoted by Ace Gutowsky who gave credit for the discovery to the nonscientific Doodlebug. The Wilcox sand in this discovery tested salt water and the well was plugged back to the Bois d'Arc lime, where oil shows had been found. It was completed on April 12, 1943, flowing 535 bbl. of 41° A.P.I. oil in 24 hours through a 9/64-in. choke.

The pool developed slowly at first but eventually became one of the major oil fields of the world. It was unitized July 29, 1947, and by February 1, 1957, the Hunton lime reservoir had produced 100,720,067 bbl. of oil and 760,910,238 M.c.f. of gas. The original unit consisted of 750 wells.

Authors are with Continental Oil Co., Oklahoma City.

Accumulation is in a huge stratigraphic trap terminated updip to the east by truncation of the Bois d'Arc lime, to the north by northwestward truncation, and to the west and south by a water table at approximately 5,930 ft. subsea. An old stream channel which had been cut completely through the Bois d'Arc in pre-Woodford time passes through the middle of the pool and divides the Bois d'Arc section of the reservoir into two parts. A later superimposed stream, as the result of early Pennsylvanian movement, followed the same drainage pattern.

. . . Short Junction field extends from a point about 2 miles west of Moore westward for over 7 miles (Figs. 6 and 7). The discovery well, Continental et al. 1 Maruska, SE SE SW 16-10n-4w, was drilled in 1948 to test in part the possibilities of a West Edmond type of Hunton trap and in part to test a Viola seismic high. Production was obtained from the Bois d'Arc lime of the Hunton group at 8,200 ft., but appeared too poor to offset. Five years later, the 106,000-bbl. production record of the Maruska well provoked new interest.

In February 1955, the Continental Oil Co. 1 Castlebury, a ¾-mile stepout, confirmed that the pool was of considerable size. At this date the field has expanded to cover 8,040 acres and has 201 producing wells. Cumulative production to December 1, 1956, was 2,761,063 bbl. of oil and ultimate production will probably exceed 25,000,000 bbl.

This stratigraphic trap is the result of updip truncation of the Bois d'Arc lime against the Oklahoma City uplift and has not yet been terminated at either end. Downdip to the southwest, production is limited by an oil-water contact of 7,053 ft. subsea established in the 5 Castlebury. Table 1 shows pertinent data concerning the above two fields as well as other pools of the truncation line type.

Fields located downdip . . . Bois d'Arc production from fields in this group is relatively limited as compared to the regional truncation line pools. In fields of this type, Bois d'Arc production is frequently associated with structural oil in deeper pays. Porosity is generally poorer than that found in the previously discussed group of pools because primary porosity has not been enhanced by weathering and leaching to as great a degree. The only field of significant size in this group is Southeast Newcastle; here, however, local truncation

SHORT JUNCTION FIELD thickness map of Bois d'Arc lime. Fig. 7.

Limestone Exploration

This part of the article discusses three classifications of the Bois d'Arc lime

may be responsible for certain unusually high recoveries.

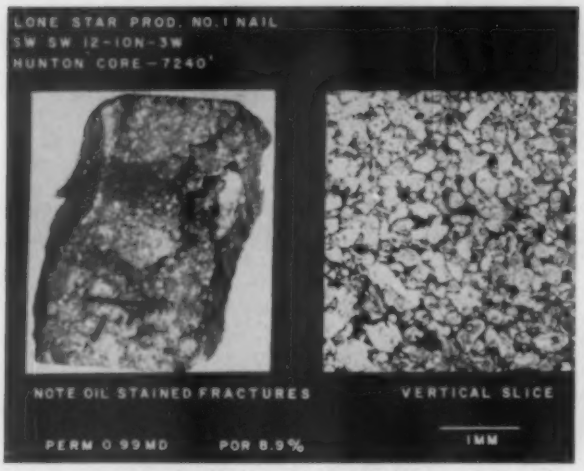
. . . Southeast Newcastle field is located 18 miles south of Oklahoma City. The discovery well was Mid-Continent Oil Co.'s 1 Berry estate, NW SW NW 32-9n-3w, completed in late December 1947. This well was drilled on seismic evidence but proved to have no closure; it was plugged back to the Bois d'Arc where it had tested oil and gas. Cumulative production from 22 wells to January 1, 1957, was 1,824,583 bbl. of oil. The two best wells have produced nearly 250,000 bbl. each.

Studies of this pool suggest that the trap in the Bois d'Arc lime results from a combination of: (1) faulting, (2) irregular porosity development in the Bois d'Arc, and (3) truncation of the Bois d'Arc lime against the Northwest Norman structure. Statistics on the other pools of this type are listed on Table 2.

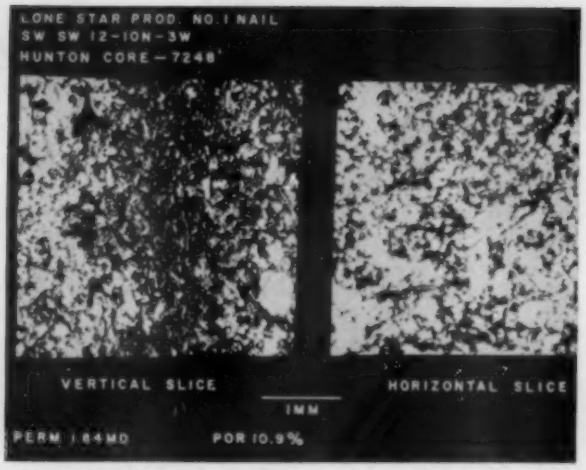
Fields in outliers updip from Bois d'Arc regional truncation line . . . Only two fields of Central Oklahoma are recognized as belonging to this group. They are Brooksville and Southwest Newalla. It seems probable that many more pools of this type will be discovered, but with present data it appears that recoveries ranging from poor to noncommercial must be predicted. Such pools are expected to be small, will probably have much salt water pro-

TABLE 1—FIELDS ALONG REGIONAL TRUNCATION LINE

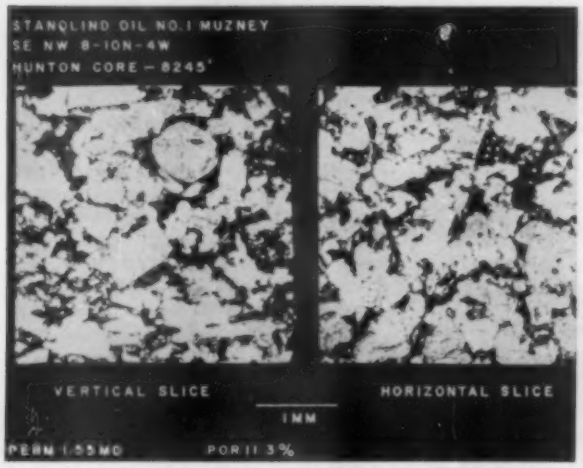
Field—	Location	Areal extent	Discovery date	Discovery well	Max. No. producing wells	Cumulative production to 12-1-56	Type trap
W. Edmond	12-13-14-15n, 4 & 5w	48.1 sq. mi. or 30,000 acres	April 12, 1943	Fox-Schmitz 1 Wagner NW NW SW 32-14n-4w	750	106,955,288 Hunton lime 100,720,067	Regional reentrant of Bois d'Arc lime and underlying members of Hunton lime against Nemaha ridge. Huge stratigraphic trap. "Doodlebug" discovery.
Short Junction	10n, 3 & 4w	8,040 acres or 12.56 sq. mi.	June 1948	Conoco 1 Maruska, SE SE SW 16-10n-4w	201	2,761,063	Stratigraphic trap due to updip truncation of Bois d'Arc lime against Oklahoma City uplift. Subsurface geology and possible seis anomaly.
Witcher	12 & 13n, 2 & 3w	9,800 acres 15.3 sq. mi.	May 1947	Harper-Turner 1 VanOstrand, SE SW 2-12n-2w	224	11,448,151	Reentrant of Bois d'Arc caused by intersection of regional truncation pattern and Nemaha ridge. Production is from Cleveland and Unconformity sands, Misener and Bois d'Arc (75 per cent plus or minus).
Romulus	7 & 8n, 4e	480 acres	Aug. 1940	J. F. Smith 1 Brown, NE SE NE 6-7n-4e	25	1,826,688	Reentrant of Bois d'Arc immediately west of west side of Seminole Plateau where steep west dip is prevalent.
Morvin	8 & 9n, 2 & 3e	640 acres	July 1937	Stano-Amerada 1 Billington "B," SW SE SW 32-9n-3e	16	802,114	Result of E-W structural nose which crosses regional truncation line.
Bethany	12n-4w	280 acres	May 1945	Phillips-Kerlyn 1 Classen, NW SE 22-12n-4w	7	783,207	Result of a structural nose coincident with truncation pattern of Oklahoma City uplift. 100 per cent Bois d'Arc production.
N.W. Cashion	16n-5w	600 acres	Sept. 1945	Carter-Phillips 1 Jirick, SW SW 26-16n-5w	15	767,539	Reentrant of Bois d'Arc along regional truncation line. 100 per cent Bois d'Arc production.
Burnett	8n-2e	280 acres	Oct. 1951	Sunray 1 State, NW SE SE 16-8n-2e	7	362,965	Topography of top of Bois d'Arc provides oil closure. Low on Viola lime. 100 per cent Bois d'Arc production.
Macomb	8n-3e	120 acres	July 1942	Atlantic 1 Hamill, NE SW 27-8n-3e	3	162,537	Structural nose coincident with regional truncation pattern.
Orchard City	11n-1w	720 acres	June 1954	Webster Drlg. 1 McNew, SE SW, 14-11n-1w	18	155,966	Bois d'Arc production not yet important. Heterogeneous reservoir of Skinner, Unconformity, Misener sands and Bois d'Arc lime on truncation line.
South Brooksville	8n-3e	40 acres	June 1943	Stanolind 1 Perkins, SW SW SW 10-8n-3e	1	87,007	One well pool along regional truncation line.



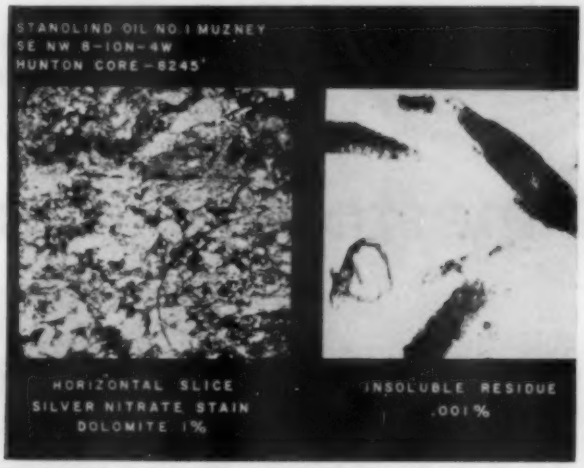
Not all reservoir properties are controlled by intergranularity (left). Variation in grain size. Haphazard arrangement of twinned grains show stacking disorder resulting in greater permeability and porosity. Recrystallization insignificant (right).



Thin section taken perpendicular to zone shown at left edge of left photomicrograph. These photomicrographs show that partial vertical stratification is present but horizontal inequigranularity affords considerable permeability and porosity.



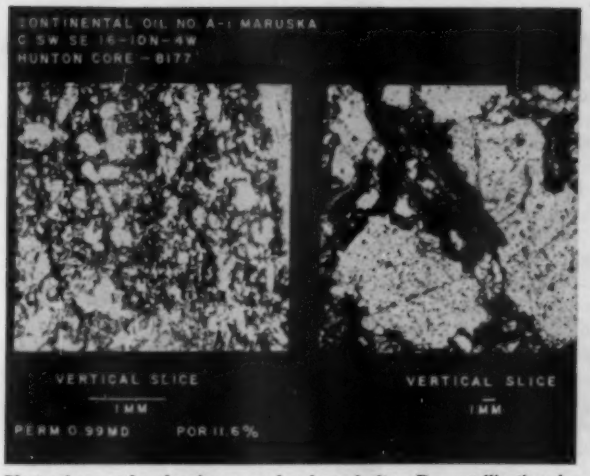
This zone has been moderately recrystallized but the data indicate that the permeability and porosity were probably increased by the active solutions. This is also the zone of maximum development of euhedral gypsum.



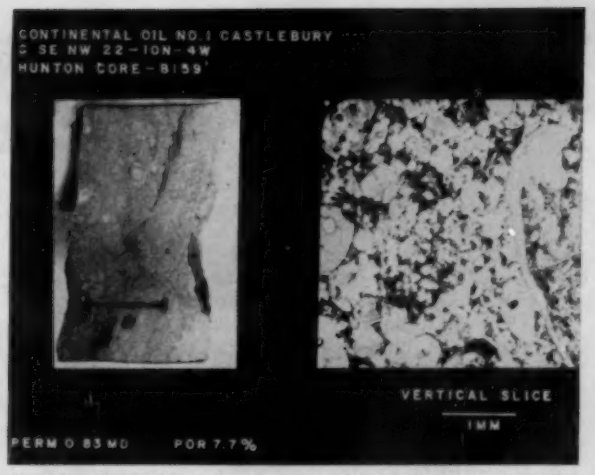
Deepness of gray (red) is controlled by grain size. All recognizable grains are stained. On right, gypsum and garnet from insoluble residue X150.

TABLE 2—FIELDS LOCATED DOWNDIP FROM REGIONAL BOIS d'ARC TRUNCATION

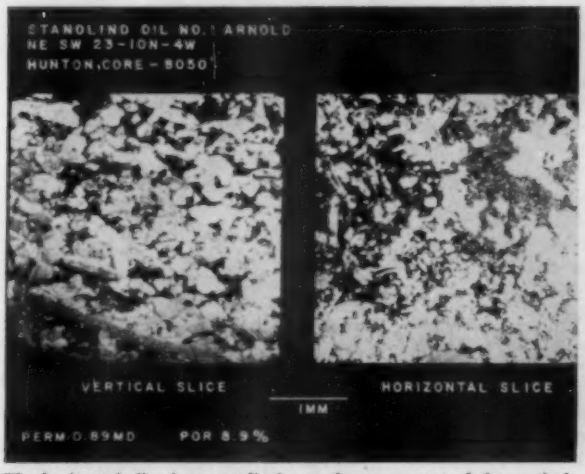
Field—	Location	Areal extent	Discovery date	Discovery well	Max. No. producing wells	Cumulative production to 12-1-56	Type trap
S.E. Newcastle	9n-3w	1,040 acres	Dec. 1947	Mid-Continent 1 Berry Est., NW SW NW 32-9n-3w	26	1,817,887	Trap is result of a combination of faulting irregular development of porosity, and Bois d'Arc truncation against NW Norman structure. 100 per cent Bois d'Arc production.
Washington	7n-3w	800 acres	Apr. 1944	Carter Oil 1 Cottingham, SE SW 4-7n-3w	5	1,965,685	Structural, possibly anticlinal with faulting. Of five wells only western two produce from Bois d'Arc.
W. Burnett	8n, 1 & 2e	80 acres	Dec. 1944	Stanolind 1 Rosebush, SW SW SW 19-8n-2e	8	971,588	Anticlinal with only three Bois d'Arc producers. Mostly Second Wilcox production.
S. Macomb	8n-3e	200 acres	Jan. 1943	Kerlyn et al. 1 Weaver, NW NE NE 32-8n-3e	5	262,507	Immediately downdip from regional truncation line where Bois d'Arc porosity is coincident with NE-SW trending structural nose. 100 per cent Bois d'Arc production.
S.W. Dover	17n-7w	260 acres	Jan. 1949	Superior Oil 1 Long, SE SE SE 16-17n-7w	13	162,490	Anticlinal structure downdip from regional truncation line which is from 2 to 4 miles updip. Of 10 wells, 8 produce Misener-Bois-d'Arc oil and/or gas. Also Simpson production.
E. Newcastle	9n-4w	80 acres	Dec. 1948	Sinclair 1 Dennis, SE NW 13-9n-4w	2	97,189	Structural trap. 100 per cent Bois d'Arc production.
Blue Hill	8n-4w	40 acres	May 1946	Carter Oil 1 Thompson, NE SE 36-8n-4w	1	47,723	Small structure, probably anticlinal. 100 per cent Bois d'Arc production.



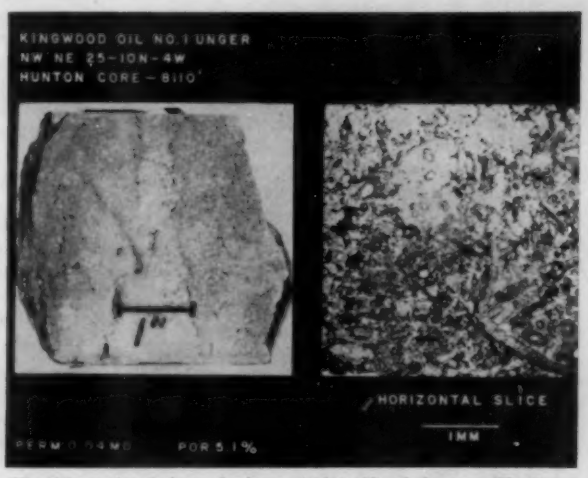
Photomicrographs showing granular irregularity. Recrystallization is negligible and there is little evidence of solution activity, indicating permeability and porosity are controlled by intergranular relationships.



Irregular distribution and orientation of fossil fragments indicating water turbulence during deposition.



The horizontal slice is perpendicular to the upper part of the vertical slice to show that in places the inequigranularity is greater in the horizontal planes.



The thin section is from the lower (right) side of the core. The lower permeability and porosity are the result of stratification and recrystallization. The insoluble residue from this core is dominated by authigenic quartz.

duction and it is anticipated that pressures will be low. Details of these two pools are shown on Table 3.

Petrology and Porosity

The authors are indebted to Dr. B. J. Scull, of Sun Oil Co., who aided materially in this study by preparing thin sections, slides, and photomicrographs of seven representative Bois d'Arc lime cores from the Short Junction-Moore area. Dr. Scull also furnished a petrological report based on insoluble residues and a great number of thin sections of these cores. His work has contributed to our understanding of certain problems regarding porosity and permeability; however, conclusions are our own and we alone accept responsibility for them.

Procedure . . . Cores were analyzed for porosity and permeability, split with a diamond saw, examined and marked into characteristic zones from which thin sections were made. Both organic and hydrochloric acid studies were made with hydrocarbon-clean samples to obtain insoluble residues and information on dolomitization. Vertical and horizontal thin sections from each core were stained with silver chromate to determine calcite - dolomite ratios. Several thin sections from each core were examined with the petrographic microscope to determine intergranular relationships and other pertinent data.

Photomicrographs . . . A series of photo-

TABLE 3—FIELDS IN OUTLIERS UPDIP FROM REGIONAL BOIS d'ARC TRUNCATION

Field—	Location	Areal extent	Discovery date	Discovery well	Max. No. producing wells	Cumulative production to 12-1-56	Type trap
Brooksville	9n-3e	480 acres	Mar. 1942	Cities Service and Atlantic 1 Fort Cobb Oil, SW NE NE 4-8n-3e	11	916,246	Buried outlier of Bois d'Arc lime coincident with structural nose.
S.W. Newalla	11n-1e	120 acres	June 1954	Republic Nat. 1 McClelland, SE SE SE 29-11n-1e	3	25,076	Buried outlier NE of truncation line. Could conceivably be connected to Bois d'Arc downdip but production history does not indicate connection.

micrographs made from selected thin sections are shown. These present the microscopic evidence for the conclusions that will follow.

Conclusions

From the photomicrographs shown, several factors of significance are immediately evident and coupled with previous studies of well samples, cores, core analyses, and experience in the area lead to the following conclusions:

1. All of the sections of cores, which were selected at random indicate the Bois d'Arc lime in this area is 99+ per cent pure calcium carbonate and almost total absence of dolomite is indicated.

2. The irregularity of crystal and fossil fragment size and shape, in addition to the heterogeneous deposition patterns, is responsible for the greater part of the primary porosity.

3. Enhancement of porosity was accomplished through the action of water circulation which left secondary crystals of gypsum and quartz as well as calcium carbonate, but the total effect was to increase permeability.

4. Fractures as seen in the photomicrographs are responsible for increase of permeability of the reservoir as evidenced by the heavier oil stain along the fracture planes.

Other pertinent information . . . The wells in Short Junction have an average of 30 to 35 ft. of indicated permeability on the MicroLog. When cored, they showed an average of 7 to 10 per cent porosity. Core analysis has also indicated a permeability of 0.1 to 10 md. Many of the cores showed both vertical and horizontal fractures; however, differences of over 1,000 psi. in 72-hour static bottomhole pressure cause some doubt as to whether the fracture system is continuous from well to well.

A typical Short Junction electrical log, MicroLog, core description, and core analysis shows that a specific zone near the center of the Bois d'Arc lime has greater porosity development, and that the overlying and underlying limestone contributes little to the production of oil and gas.

The fact that solution weathering would take the line of least resistance makes it apparent that this zone was inherently more porous than the other zones and was therefore subject to greater porosity enhancement. In many instances where the limestone superjacent and subjacent to this zone have been subjected to greater erosion due to exposure, they show poor to fair porosities, but are not so effective as the innately porous zone, which was more subject to weathering effects discussed in this paper.

Drilling, Completion and Production Practices

The recent development of Short Junction field has given both operators and service companies an opportunity to adapt the latest production methods to the Bois d'Arc lime. The following information is based on the experience of Continental Oil Co. in completing and producing 90 wells in the Short Junction area. It is believed that the procedures related will yield good results throughout Central Oklahoma in the subject limestone.

Drilling procedures . . . Wells in Short Junction vary from 7,900 to 8,200 ft. in depth and are drilled and completed in about 30 days. Approximately 850 ft. of surface pipe is set to protect the fresh water of the Garber sandstone. Wells are mudded up at a depth of about 5,000 ft. unless good samples are desired from some shallower Pennsylvanian bed. Lost-circulation material is generally placed in the mud prior to drilling into the Bois d'Arc lime. It is standard practice to add crude oil to the mud to facilitate drilling and decrease water loss. Standard electrical logs and MicroLogs or contact logs are run when wells reach total depth, normally about 40 ft. into the Haragan lime which lies below the Bois d'Arc.

Completion procedures . . . The usual oil string is a mixed weight string of 5½-in. casing. A neutron log is usually run after pipe has been set to correlate the collars with the productive intervals indicated on the MicroLog or contact log. In almost all instances all of the indicated permeability is perforated with jet shots at a density of four holes per foot.

The completion practices vary widely from as little as 500 gal. of mud acid to 30,000 gal. of gelled 15 per cent HCl. In early development stages sand was used with the gelled acid but this practice has largely been abandoned. Sand-oil fracturing also has been used as a completion method with jobs varying from 15,000 to 40,000 gal. The initial potentials of almost all of the wells have been high but several have had a rapid decline; which is indicative of the tight, low-porosity productive section.

A typical completion is difficult to recite; however, a small mud-acid treatment, followed by a 5,000 to 10,000-gal. gelled-acid treatment, is about as popular as any. A well with a thick pay section would not have a much higher initial potential than a thin-pay-section well. However, its pressure drawdown per barrel is generally much less than in a thin-pay-section well. Wells with thin-pay sections, whether treated heavily or lightly and whether updip or downdip, have about the same performance. With only one or two exceptions, wells with thin-pay sections are less productive than those with thicker sections, regardless of structural position. The converse of this is also true with few exceptions.

Production . . . Remedial work on thin-pay-section wells to date has not been successful always. However, those wells with thicker pay sections have responded.

Short Junction Bois d'Arc lime oil is a paraffinic crude of 37.4° A.P.I. gravity. The solution gas-oil ratio of the oil is, in this field, approximately 1,050 cu. ft. per bbl. with an initial reservoir pressure estimated at 3,600 psi. Production to date indicates the primary producing mechanism to be that of solution gas drive with limited effect of water encroachment. A very small effect may be detected from two or more gas cap pockets on the upstructure side of the reservoir.

Future production characteristics will probably be very similar to those of the West Edmond Hunton lime pool. As the bottom-hole pressure is drawn down, the GOR will climb rather rapidly with corresponding decrease in oil production.

Considering the revenue from both the oil and gas with its recoverable liquids, the wells will provide a fair return to the operators on the money invested.

Facts and figures . . . Since Short Junction field is still undergoing development and is the most recent example of profitable Bois d'Arc production, a few facts and figures are in order. A typical dry hole drilled to 8,200 ft. in this area will cost about $45,000. A typical well completed with tanks, based on an average of 38 wells, represents an investment of $75,000. A typical mud program costs $2,250.

An interesting fact pertaining to the revenue from Short Junction field is that about 25 per cent of the total income will result from gas and its by-products. The less productive portions of the field will have per acre yields of at least 2,300 bbl. of oil and 16 M.M.c.f. of gas. Better parts of the field will yield at least 3,000 bbl. of oil plus 20 M.M.c.f. of gas per acre.

Operators will look toward more efficient operation to make lime production, which now suffers by comparison with sand production, relatively more profitable. This is exemplified by Continental Oil Co.'s Short Junction gasoline plant which will be completed by July 1957. This plant is of the absorption type and uses an ammonia refrigeration system. The plant will have

a daily gas capacity of 60 M.M.c.f. and its products will be 50 per cent natural gasoline, 25 per cent propane, and 25 per cent butane.

Economic Considerations

Limestone production, particularly the lime of the Hunton group, has long had a notorious reputation of low recoveries and small chances for a fair profit. As the more profitable sand production of Central Oklahoma becomes harder to find, operators will look with more and more favor on careful prospecting for Bois d'Arc lime in this area and will count on improved production practices and more efficient operation to make it profitable. Future discovery of the Bois d'Arc oil pools need no longer be dependent upon accident and luck. Enough information is now available to prevent the well-informed from exploring its potential in areas devoid of the necessary prerequisites for sufficiently good reservoir characteristics. We believe that future exploration will remove the cloud of pessimism from Bois d'Arc limestone production, as sound, scientific research isolates the more favorable localities. We believe that many more profitable Bois d'Arc lime fields will be discovered in Central Oklahoma and in adjacent areas in the years to come.

Acknowledgments

The writers wish to express their gratitude for various types of assistance to all Continental personnel who aided, and particularly to thank Dr. B. J. Scull, of Sun Oil Co., R. P. Clinton, of Pure Oil Co., H. B. Steves, and L. L. Tucker. Special thanks are due the Continental Oil Co. which graciously gave its permission for the writers to prepare and present this article. **End.**

EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

A new deep wildcat location has been made in Ligonier Township, Westmoreland County, Southwest Pennsylvania. It is by Felmont Oil Corp. 1 Pennsylvania Game Commission, Tract 42, Somerset Quadrangle, 1.0 mile south of latitude 40 degrees 15 minutes and 1.7 miles west of longitude 79 degrees 05 minutes, elevation 2,574 ft.

WEST VIRGINIA

In Falling Springs district, Greenbrier County, West Virginia, Columbian Carbon Co. 1247 Cherry River Boom & Lumber Co., wildcat, elevation 2,884 ft., reached the Benson sand at 4,519-70 ft., with a show of gas at 4,539 ft., total depth 4,667 ft. This well will be fractured.

● Gore district, Hampshire County, this company's 1228 Lonza Kidwell, elevation 953 ft., reached the Oriskany sand at 5,588 ft., and is running 5-in. casing at 5,594 ft.

● In Dry Fork district, Randolph County, Hope Natural Gas Co. 9999 U.S.A., elevation 3,105 ft., topped the Oriskany sand at 6,504 ft., with gas testing 22,000 cu. ft. before fracture and 37,000 cu. ft. after. Cleaning out is in progress.

● Licking district, Tucker County, this company's 10017 Thaddeus Pritt is drilling at 4,634 ft. The Oriskany sand at 4,580 ft. had gas testing 660,000 cu. ft.

OHIO

Cambridge Oil & Gas Co. completed a large gasser along the north edge of the old gas pool in southern Hopewell Township, Muskingum County, and 1½ miles southeast of Gratiot. On 1 (2) G. L. Starkey, Section 3, Clinton was found at 3,254-93 ft. with 600,000 cu. ft. natural and 5,900,000 cu. ft. after fracture.

● In the first quarter of Hanover Township, Licking County, J. W. Collins 1 D. M. Romine logged the Clinton at 2,888 - 2,938 ft. with 200 ft. showing natural and 105 bbl. in a 24-hour test after fracture.

● Evidence of an oil pay in central Knox Township, Holmes County, was found by the Natol on 3 I. E. O'Hail Heirs, Section 17. Clinton at 3,167-3,226 ft. gaged 40 bbl. of oil and 500,000 cu. ft. gas in 24 hours after fracture.

CALIFORNIA

Willows Gas Find

Doheny-Natural Gas was completing 1 Vestner as a new gas pool discovery 2 miles east of Willows gas field in Glenn County. On an earlier formation test of the interval 5,086-92 ft., the operator reported a flow at a rate of 2,275 M.c.f. daily through a 26/64-in. choke. Two-inch tubing was being run after six ½-in. holes per foot were shot between 5,044-66 ft. and 5,020-38 ft.

Bridge Area Extended

Ferguson & Bosworth, operators, were running 2½-in. tubing in a 10,039-ft. extension test on the east flank of the Bridge pool area, South Mountain field in Ventura County. The operators reported recovering a 6,000-ft. rise of gas and oil-cut drilling fluid on a 1-hour production test of an interval at 9,150-9,456 ft.

CANADA

ALBERTA

Cardium Strike Hinted At Pigeon Lake Well

Pan American Petroleum Corp. and the California Standard Co. team found indications of Cardium sand oil production at a well in the Pigeon Lake Devonian D3 field.

The No. 12 Pigeon Lake, LSD 7, 24-46-28w4, ran cored at 3,882-3,916 ft. During reaming of that cored interval, the well kicked off and unloaded about 75 bbl. of light-gravity Cardium oil into the mud pit. The operator is now drilling on down to its D3 zone objective.

Texaco Exploration Co. has one well 1¾ miles northeast of this Cardium prospect that is already on steady production from that zone.

Success Hinted at High River Follow-Up

The follow-up well to the High River area discovery in southern Alberta appears to be an oil producer. Texaco Exploration Co. recovered 120 ft. of clean oil and 240 ft. slightly oil and gas-cut mud and 1,150 ft. water cushion, slightly gas-cut, on test of the Devonian D1 zone.

The discovery well at High River flowed 326 bbl. of oil per day from the D1.

The new well, 12-19 High River, is on LSD 12, 19-18-29w4. It is lo-

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cated ⅝ mile southeast of the A1-25 discovery well and is 5 miles southwest of the town of High River, 30 miles due south of Calgary.

SASKATCHEWAN

American Firm Gets Oil At First Provincial Try

Williamson Drilling Co. found oil at its first hole in a five-well drilling program in southeastern Saskatchewan. The 16-21 Frobisher, 1¼ miles south of Frobisher oil field, 1½ miles northwest of 7-15 Frobisher, an Imperial discovery, and 23 miles east of the town of Estevan, flowed at the rate of 10 bbl. per hour on production test.

The 16-21 Frobisher discovery is on LSD 16, 21-3-4w2. It topped the Charles-Mississippian at 4,700 ft. Completion was at total depth of 4,907 ft. The pay showed 36 ft. of net porosity. The Mission Canyon zone failed to indicate any oil.

KANSAS

SOUTHWEST

Morrow Discovery Seen At Comanche County Well

A wildcat in southwestern Comanche County appears to be a Morrow-Pennsylvanian gas discovery. Pure Oil Co. 1 Tuttle "B," C SW SW 6-35s-20w, gaged 2,930 M.c.f. of gas daily from perforations in the Morrow at 5,442-5,625 ft. Recovery included 420 ft. of gassy, slightly oil-cut mud.

Pure's indicated strike is located 4 miles southeast of Snake Creek field in Clark County and 12 miles south of the town of Protection.

LOUISIANA

SOUTH LOUISIANA

Deep Wildcat Staked in Northwest Vermilion Bay

Sunray Mid-Continent Oil Co., as operator, and Buffalo Oil Co. and Skelly Oil Co. have staked a location for a 16,500-ft. lower Miocene test in Northwest Vermilion bay in Vermilion Parish, Louisiana.

The wildcat, located 3 miles southwest of the multiple-zoned Intracoastal city field, is on a block of 2,200 acres of state water bottoms on State Tract 3020. Location is 5,525 ft. south of Vermilion bay West Light in 15s-3e.

MICHIGAN

Second Salina Well at Dorr Appears Successful

The second successful Salina objective oil and gas well in the Dorr pool, Allegan County, appeared assured at Louis Zellman 5 B. Zellman, SE SE NE 25-4n-13w, while another test well in the area located exactly ½ mile north of the first Salina producing well in this area was drilled out dry in objective pay horizons.

The 5 B. Zellman showed an estimated three to five bailers of free oil and about 100,000 cu. ft. of gas a day natural from Salina pay section at 2,769 ft., total depth. If well responds as successfully as the first producer in the area to acid treatment, satisfactory production—oil with a high gas ratio—should be established. New potential producer is the diagonal southeast 20-acre offset to the 4 B. Zellman Salina discovery. Both were small Detroit River oil producers deepened to the so-called A-2 Salina dolomite zone.

Meanwhile, Everett McIntire drilled a Salina zone failure at a location ½ mile north of the 4 B. Zellman producing well. This dry test was drilled at the 1 Brenner, NW SW SW 24-4n-13w, which was bottomed out dry at 2,818 ft., total depth. This outpost was checked in structurally lower than the discovery by about 26 ft.

OKLAHOMA

SOUTHERN

Deep Love County Test Finds Oil Creek Production

The Texas Co. appears to have hit another deep Oil Creek - Ordovician sand gas-distillate pool in the Southeast Marietta district, north of its Westheimer discovery at Southwest Enville. The 1 Dexter, NW SE SE 7-7s-3e, found gas at 8,668 ft. and is drilling ahead in the Oil Creek sand.

SOUTHWEST

Springer Is New Pay at Knox Deep

British-American Oil Producing Co. found gas in the Springer at 1 Teter in the deep Knox field play of Grady and Stephens counties. The new pay was found at the cost of Big Chief Drilling Co.'s rig, however.

The well flowed 12,000 M.c.f. of gas per day from the Springer below 10,816 ft. A storm ignited the gas when the well blew out, destroying the rig.

The Springer is the fourth pay sand in this deep Knox field play where the state's deepest production is found. The other pays are the Viola, Second and Third Bromide sands.

NORTHERN

Northeast Cherokee Field Adds Eighth Producer

The eighth producing well has been completed in new Northeast Cherokee field, Alfalfa County. Gulf Oil Corp. 3 Botleman, C SW SW 19-27n-10w, flowed 88 bbl. of oil in 6 hours on 20/64-in. choke from perforations in the Cherokee at 5,180-5,206 ft. Davon Drilling Co. opened this field several weeks ago. It is located several miles of the existing basal Pennsylvanian trend across the northern parts of Alfalfa and Grant counties.

Phillips Petroleum Co. is busy at 2 Newton-A in C SE SE 19 and at 3 Newton-A in C NW SE 19.

OREGON

Current Activity

Standard Oil Co. of California was drilling ahead below 7,400 ft. at 1 Kirkpatrick in the Condon area of Gilliam County.

Sunray Mid - Continent Petroleum Corp. is reportedly going to drill a wildcat in Multnomah County.

ROCKY MOUNTAIN

WESTERN NEBRASKA

Huber Shuts In Apparent Garden County Strike

A Dakota gas discovery in Garden County has been shut in. It is J. M. Huber Corp. 1 Olsen in C NW SE 11-16n-44w, south of the North Platte River and south of Oshkosh.

A drill-stem test at 3,036-49 ft. flowed gas at the estimated rate of 10,000 M.c.f. per day. Location of this gas well is 3½ miles south of McCord field, a small oil producer. The county's only other production is at Richards field.

UTAH

Tohonadla Discovery Is Now Paradox Prospect

Shell Oil Co.'s 1 Tohonadla discovery in W½ SW SW 35-41s-21e, San Juan County, is now an indicated Paradox

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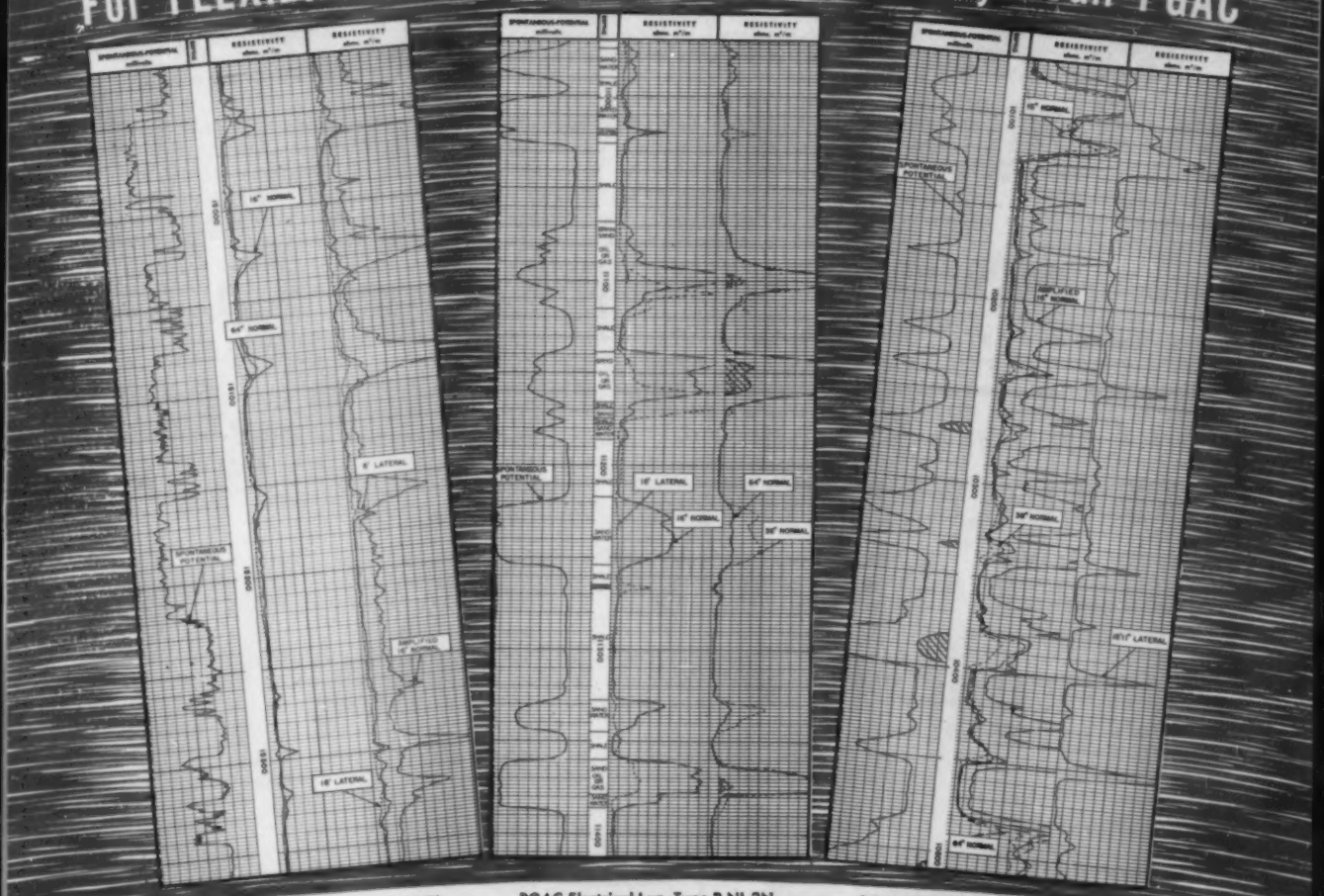

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 97.87 acres of land in three parcels within the known geologic structure of Rangely Field, in Rio Blanco County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., July 25, 1957, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that 647.20 acres of land within the known geologic structure of the Caddo-Pine Island, Naborton, Greenwood-Waskom and Rodessa Fields in Caddo and De Soto Parishes, Louisiana, will be offered for oil and gas leasing through competive bidding to the qualified bidder of the highest cash amount per acre at 1:00 P.M., EST, June 19, 1957, when bids will be opened. Details of the lease offering, description of the lands, how and where to submit bids, and bid forms may be obtained from the Manager, Eastern States Land Office, Bureau of Land Management, Washington 25, D. C., H. K. Scholl, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 80 acres of land in one parcel within the known geologic structure of Happy Hollow Field, in Delta County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., July 26, 1957, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

producer. Previous production was found in the upper Hermosa at 528 bbl. per day. A drill-stem test at 5,527-5,665 ft. in the Paradox recovered 630 ft. of mud and gas-cut oil, 1,365 ft. of heavily oil and gas-cut mud and 105 ft. salt water.

This discovery is 6 miles northwest of North Boundary Butte field in the Paradox basin. It is the westernmost production in the basin.

WYOMING

Big Piney Will Get Deep Wildcat

Famous Big Piney field in Sublette County, Wyoming, will get a 9,000-ft. Frontier test. Belco Petroleum Co. will drill the 1 Deer Hill in the northern part of the field, ¼ mile south of a Continental Oil Co. 1953 gas discovery in the Almy sand at the shallow 2,288-ft. mark.

Big Piney has been a shallow gas producer for many years. Lack of outlet left its mark on the field's development, however. Then came the Pacific Northwest Pipeline through this section of the Green River basin and development began to stir. There are now 46 new gas producers in the Almy sand in this field, drilled by Belco and Belfer Natural Gas Co. The deep Frontier test may shed new light on the deep prospects of this field. The Frontier is fast becoming an important future reservoir for gas. Recent discoveries at Hogsback and Birch Creek, Wyo., have proved its overlooked worth.

NORTH DAKOTA

Structure Contour Map Of Nesson Anticline

A map showing geologic structure and oil field development in part of the Williston basin was released to open file by the Geological Survey.

The map covers an area of about 1,300 sq. miles, including parts of eight counties in northwestern North Dakota. It shows 11 oil fields on Nesson anticline with development and well status as of January 1957, and the location and date of discovery for each field.

Structure contours have been drawn from subsurface data on the base of the lowest salt bed of the Upper Mississippian Charles formation (approximate top of Mission Canyon formation of the Madison group). Structural features include the Sanish fault, Kildeer syncline and the White Earth syncline. Principal cultural features of the area are also shown.

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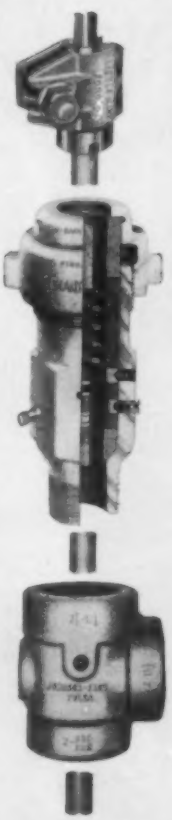

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The map is on file at the office of the North Dakota Geological Survey, Grand Forks, N. D. and copies are available at $1.50 each. Requests should be addressed to State Geologist, University Station, Grand Forks, N. D.

COLORADO

North Park Basin Field Trip Announced

The Rocky Mountain Association of Geologists will hold its annual field trip for 1957 in the North and Middle Park areas of Colorado on August 21-24. The guidebook and the lecture stops will deal with the stratigraphy (Triassic through Pliocene?), tectonics, realized and potential oil and gas reservoirs, uranium, and other minerals. The book will contain the first published areal geological map of the North and Middle Park basins, and will also include detailed road logs of the trip. For details contact R. C. Johnston at Pan American Petroleum Corp., Box 509 in Denver.

TEXAS

WEST TEXAS

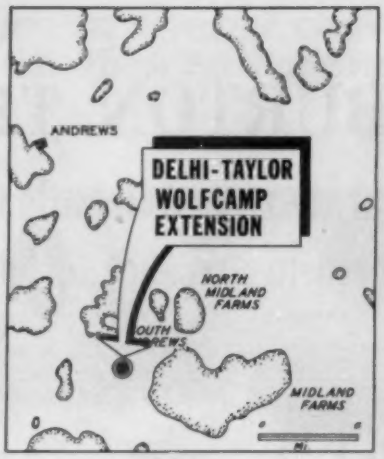
Motley County Gains Second Oil Producer

Motley County, located in northeastern West Texas, and which recently joined the ranks of producing counties, now has a second producer. The well is Pan American Petroleum Corp. 1 A. W. Payne "A."

Pan American Petroleum's second well flowed 112 bbl. of oil a day from the Permo-Pennsylvanian section at 4,131-75 ft. There was no water. Gas-oil ratio was 143:1, choke was 18/64-in.

Location is SE NE Section 7, Block 0-4, WTRR Survey, 5 miles east of Roaring Springs townsite, and ½ mile northeast of Pan American Petroleum's pool discovery. The same operators have made location for their 1 H. L. Egger, ⅜ mile northeast of the second producer, in Section 6.

Upton County . . . Pure Oil Co. 1 TXL, an Ellenburger project which flowed 200 bbl. of oil in 6 hours from a section of the Wolfcamp, recovered 30 ft. of distillate cut with water blanket, and 2,250 ft. of heavily gas-cut mud, with a small amount of distillate, on initial test of the Ellenburger. Flowing pressure ranged from 5,360-5,765 psi. Drilling continued below 13,153 ft.



Delhi-Taylor's Wolfcamp discovery, or extension to South Andrews field, flowed 524 bbl. of oil a day on completion test.

Andrews County Well Flows 524 Bbl. on Potential

Delhi-Taylor Oil Corp. et al 1-32 University has extended Wolfcamp production to the southeast of South Andrews field, in Central Andrews County. The new well may be given discovery status, since it is slightly over 1 mile from present production. It is also ½ mile southwest of a 10,780-ft. Mississippian failure, which may indicate a new producing structure,.

Potential at 1-32 University was 524 bbl. of 41-gravity oil a day through ¼-in. choke. Gas-oil ratio was 891:1 and tubing pressure 775 psi. Completion perforations were at 8,749-54, 8,758-64 and 8,784-88 ft. Location is SW NW Section 32, Block 1, University Lands Survey.

Another test holding interest in Andrews County is J. G. Kluthe and Osborn & Miller 1 University, scheduled to 12,800 ft., ½ mile northwest of Fasken (Wolfcamp and Ellenburger) field.

On drill-stem test in the Wolfcamp at 8,635-70 ft., the well flowed 15 minutes at the rate of 20-25 bbl. an hour through 1-in. choke, then reversed out a full string of oil. Flowing pressure reached 770 psi. Location is Section 14, Block 1, University Lands Survey, and 9 miles southeast of Andrews.

TEXAS GULF COAST

Franks Extension Well Completed in Galveston

Placid Oil Co. et al completed the 1 C. E. Franks et al Oil Unit 4 for 312 bbl. of oil per day from perforations at 10,965-73 ft. in the Schenck sand. This well extends Franks production 1,100 ft. southwest. The flow was on 7/64-in. choke. Location is on the E. de los Santos Coy Survey, A-49, 1 mile east of Alta Loma in Galveston County.

Gage Taken at Two Wells in Southwest Redfish Reef

Sun Oil Co. 1 State Tract 307, 9 miles north of Texas City in the Southwest Redfish area, flowed at the rate of 249 bbl. of oil daily on 11/64-in. choke. Perforations are at 10,836-46 ft. Location is in Galveston Bay.

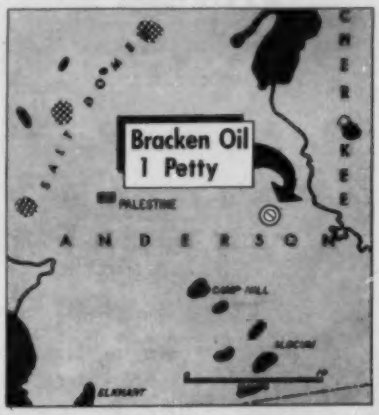
Sun will also complete 3 State Tract 288 from 10,182-98 ft. and 10,490-10,502 ft. From the first zone the well flowed 3,378 M.c.f. of gas and from the second 327 bbl. of oil. Location is 1,328.5 ft. southwest of the No. 2 oil well, also in Tract 288.

Frio-Vicksburg Discovery Completed Near Raywood

Bankline Oil Co. completed the 1 Price and Bill Daniel 1¼ miles south of Raywood field in Liberty County.

The Frio-Vicksburg discovery flowed oil at the rate of 64 bbl. daily on ¼-in. choke. Perforations are at 7,348-51 ft. This well extends production 9,000 ft. southeast of Raywood field. Location is on the Peter Mason Survey A-69.

EAST TEXAS



Map shows location of Bracken Oil Co. 1 Amelia Hassell Petty, Woodbine wildcat in southeastern Anderson County. Top of the Woodbine was reported at 4,716 ft., with oil shows starting at 4,620 ft. Projected depth is 6,000 ft.

Gas Discovery Gaged In Robertson County

B. B. Orr 1 Abraham, gas discovery 5 miles southwest of Bremond in Robertson County, has been rated up to 15,000 M.c.f. of gas a day. Pay is the

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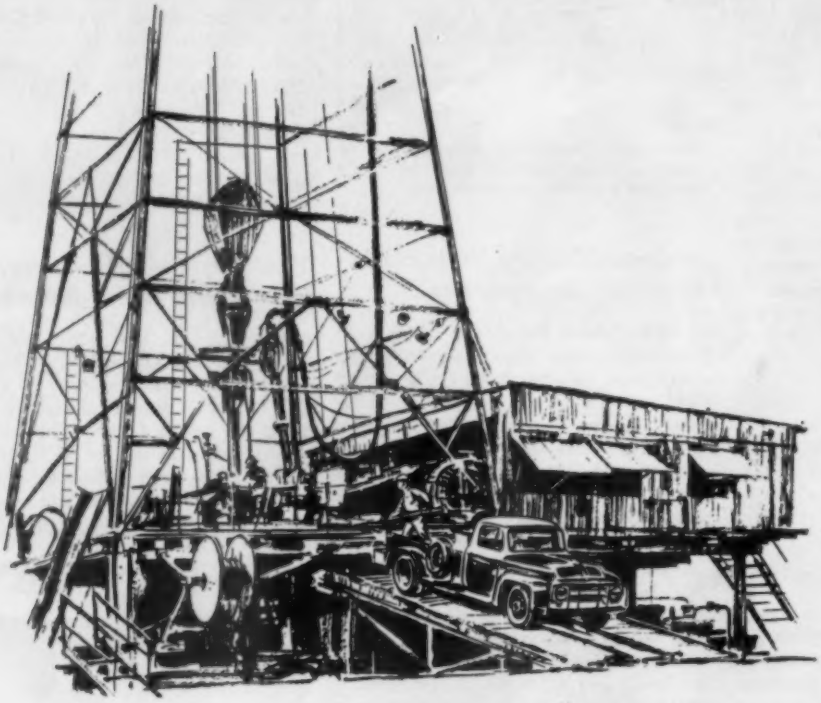

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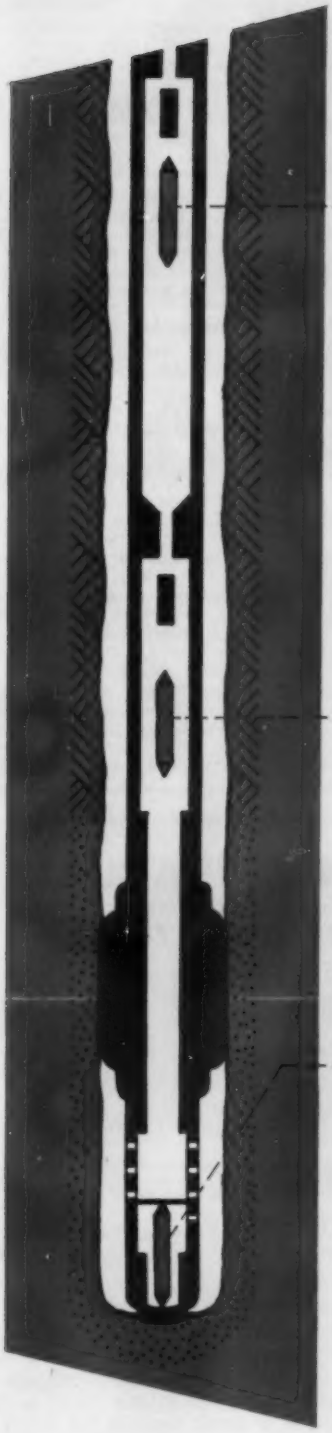

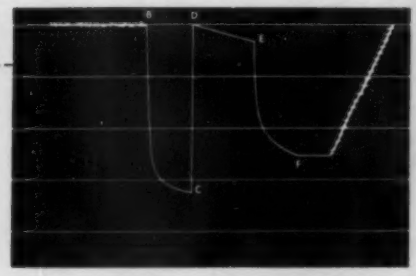

Chart From Gauge In Air Chamber

CHART DESCRIPTION

A	Tester Valve Opened
B	Mud Pressure Relieved Formation Pressure Build-Up Starts
B-C	Initial Closed-In-Pressure Build-Up Curve
C	Auxiliary Valve Opened
D-E	Flowing Pressure Curve
E	Closed-In-Pressure Valve Closed
E-F	Final Closed-In-Pressure Build-Up Curve

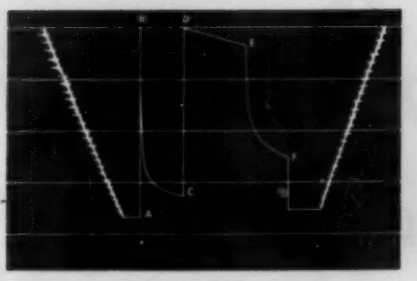

Chart From Gauge In Flow Stream Below Tester Valve

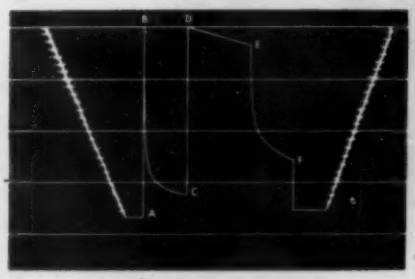

Chart From Blanked-Off Gauge

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Edwards limestone at 4,726-31 ft. Location is in the Dennis Hagerty Survey.

TEXAS PANHANDLE

Furr Completes Cleveland Sand Gas Discovery

Roy Furr 1 Furr-Southland-Edwards in south-central Hansford County was completed producing gas-distillate from the Cleveland-Pennsylvanian sand at 6,048-58 ft. The well had an absolute open flow potential of 8,900 M.c.f. per day plus 8 bbl. of distillate per million. During production tests the discovery made as much as 10,000-20,000 M.c.f. per day.

WASHINGTON

Current Activity

Utah Consolidated Oil Co. was running an electric log at 22-1 Swanson Unit. This well is in the Western Columbia basin, near Copalis Beach, Grays Harbor County. Present depth is 4,056 ft. Utah reports the top of the zone at 3,900 ft. They made three trys to run an electric log but failed. Another is planned.

McCulloch Oil Exploration Co. 1 Pasquier in the Enumclaw area of King County ran an electric log, microlog and dipmeter. No information was available. Total depth is 4,564 ft.

Successful Wildcats

ALBERTA

B.A. et al, 7 Dhenin, LSD 7, 14-40-16w4. TD 4,274 ft. Blairmore gas well.

Canadian Chieftan 7-14 Provost, LSD 7, 14-34-7w4. TD 3,439 ft. Viking gas well.

British American et al 10 Bricker, LSD 10, 4-30-1w4. TD 2,955 ft. Viking gas well.

SOUTH LOUISIANA

Lafourche Parish: Natural Gas & Oil Co. 4 Lafourche Parish School Board, 16-19s-23e. IP 51 BOPD and 2,060 M.c.f. daily, 11/64-in., 53.6°, perforations 10,116-20 ft. TD 14,575 ft. (New pay in Kings Ridge field.)

Humble Oil & Refining Co. 2-B Alton Jones et al, 30-17s-23e. IP 219 BOPD, ⅛-in., 34.5°, GOR 863 cu. ft. per bbl., perforations 10,870-86 ft. TD 11,050 ft. (New pay in Little Temple field.)

Olin Gas Transmission Co. 1 Hunt Unit 7, 34-19s-23e. IP 3,500 M.c.f. daily, ⅛-in, spray condensate (ungaged), perforations 13,140-13,150 ft. TD 13,247 ft. (New pay in Lake Enfermer field.)

TEXAS GULF COAST

DeWitt County: Harkins & Co. and George Musselman 1 Musselman, Green DeWitt Sur., A-15 (4 miles northwest of Thomaston). IP 103.13 BOPD, 9/64-in., 33.1°, GOR 642 cu. ft. per bbl., perforations

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7,720-23 ft. (Wilcox). TD 8,015 ft. (New field.)

Nueces County: Delhi-Taylor Oil Corp. 2 Moore, Share 9, Bluntzer Partition Sur. IP 62.6 BOPD, 7/64-in., 28.9°, GOR 6,300 cu. ft. per bbl., perforations 6,350-52 ft. (Vicksburg-Koehler sand). TD 5,913 ft. (New pay in Knolle field.)

Spartan Drilling Co. 1 Guaranty, Section 52, G. H. Paul Subd., Driscoll Ranch. IP 84 BOPD, ⅛-in., 32°, GOR 1,500 cu. ft. per bbl., perforations 7,941-44 ft. (Frio). TD 8,100 ft. (New pay in West Minnie Bock field.)

San Patricio County: Carrl Oil Co. 2 Chapman, Section 44, G. H. Paul Subd., J. J. Welder Ranch. IP 126 BOPD, 7/64-in., 36.5°, GOR 630 cu. ft. per bbl., perforations 5,498-5,500 ft. (Frio). TD 5,977 ft. (New oil reservoir in Hibernia field.)

EAST TEXAS

Anderson County: Texkan Oil Co. 1 G. B. Wallace, E. Austin Sur., A-88, 3 mi. S Slocum. IP 4,800 M.c.f. gas, plus 47 bbl. 70-gravity condensate per 1,000 M.c.f., Woodbine perforations 5,867-76 ft. TD 6,042 ft.

WEST CENTRAL TEXAS

Haskell County: Great Lakes Carbon Corp. et al 1 Scott estate, J. H. Parkhurst Sur. 46, 4 mi. SE Sagerton. IPP 61.5 BOPD, 40-gravity, GOR 385, top Swastika sand 2,795 ft., TD 2,816 ft.

Nolan County: Dan & Jack Auld and Warren Petroleum 1 G. W. Parker, 57-22-T&P, 1 mi. SW Sweetwater. IPP 157 BOPD, 34-gravity, GOR 175, Cisco sand 4,194-4,204 ft. TD 6,690 ft., elev. 2,228 ft.

Stephens County: Big D Oil Co. 1 Ross Sloan, Sec. 1164, TE&L Sur., 14 mi. N Breckenridge. IP 35 BOPD, 10/64-in., 42-gravity, GOR 950, TP 550 psi., pay 4,093-95 ft. TD 4,443 ft.

Taylor County: Columbian Fuel Corp. 1-B W. S. Shaffer, 154-64-H&TC, 6½ mi. NW Bradshaw, ¾ mi. N Shaffer-Strawn field. IP 152.5 BO in 8 hr., ½-in., 40-gravity, GOR 598, TP 225 psi., Cross Cut sand 4,379 ft., perforated 4,386-96 ft. TD 5,000 ft., elev. 2,117 ft.

Throckmorton County: C. G. Glasscock-Tidelands Oil Co. 1 H. L. Thornton, Sec. 3031, TE&L Sur., 5 mi. NE Throckmorton. IP 153 BOPD, 16/64-in., 40-gravity, GOR 200, TP 200 psi., conglomerate 4,739 ft. TD 4,855 ft.

WEST TEXAS

Dawson County: Camp Oil Co. and J. E. Jones Drilling Co. 1 Middleton, 30-34-T5N-TUP, 6 mi. SE Lamesa. IPP 115 BOPD, 39-gravity, GOR 390, Spraberry 7,377-79, 7,383-91 ft. TD 8,830 ft.

Gaines County: Pan American Petroleum Corp. 1-A Blanchard, 271-G-WTRR, 1½ mi. SW Seagraves. IPP 125 BOPD, 32°, GOR 161, San Andres 5,450-90 ft. TD 11,639 ft., PB 5,495 ft. New pay in ODC-Devonian field.

Howard County: Woodson Petroleum Co. 1 Pauline, 57-20-Lavaca Navigation Co. Sur., 22 mi. NE Big Spring, ¼ mi. NW Canyon production. IP 497 BOPD, 44-gravity, GOR 897, TP 800 psi., reef perforations 7,448-63 ft. TD 7,828 ft. Elev. 2,355 ft.

Loving County: William D. McBee, Jr., 1 TXL, 39-53-T2-T&P, 6½ mi. NE Mentone. IPP 41 BOPD, 39-gravity, Delaware 4,600-13 ft. TD 4,613 ft.

Pecos County: Standard Oil Co. of Texas 4 Claude Owens 2, 4-C4-GS&SF, 10 mi. SW Iraan, 3 mi. SW Yates field. IPP 29 BOPD, 35-gravity, Cisco 6,662-75 ft. TD 9,575 ft., elev. 2,482 ft.

Schleicher County: Ashmun & Hilliard 1 Mary Robinson, 39-1-GH&SA, 15 mi. NE Eldorado. Recompleted as discovery. IP 113 BOPD, 18/64-in., 36-gravity, GOR 550, TP 120 psi., Canyon 4,593-4,602 ft. TD 6,216 ft., PB 4,765 ft.

Terry County: J. C. Williamson 1 Green, 93-D11-C&MRR Sur., 11½ mi. W Brownfield, 4½ mi. NW Black-Devonian field. IP 237 BOPD, 16/64-in., 36-gravity, GOR 640, TP 125 psi., Wolfcamp perforations 10,040-60 ft. TD 12,705 ft.

Terry County: The Texas Co. 1 M. F. Taylor, 129-D11-C&M Sur., 42½ mi. SW Gomez. IP 238 BOPD, 23/64-in., 34.8°, TP 50 psi., Devonian 12,759-69 ft. TD 12,770 ft. Elev. 3,389 ft., top Devonian 12,765 ft.

Yoakum County: Pan American Petroleum Corp. 1 M. M. West, Sec. 606, Blk. D, J. H. Gibson Sur., 9 mi. SW Plains. IP 295 BOPD, 7/64-in., 40°, GOR 74, TP 580 psi., Devonian 11,058-77 ft. TD 11,250 ft., elev. 3,661 ft., top Devonian 11,058 ft.

NORTH TEXAS

Baylor County: Bobby M. Burns 1 Green "B," Blk. 229, T&NO Sur., A-371, 1½ mi. NE Rendham. IP 252 BOPD, 14/64-in., 42-gravity, GOR 562, TP 680 psi., Mississippian 5,415 ft. TD 5,426 ft.

Knox County: Grace-Schlittler Operating Co. 1 Benedict, 58-2-D&W, 1 mi. NE Knox City. OWDD, recompleted as discovery. IPP 85 BOPD, 39-gravity, GOR 250, Strawn reef 4,674-79 ft. TD 4,742 ft.

Katz Oil Co. 1 Wylie, 53-2-D&W, 2 mi.

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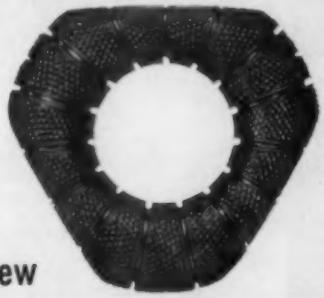

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NW Knox City. IP 111 BOPD, 18/64-in., 38-gravity, GOR 175, TP 50 psi., Strawn 4,861-67 ft. TD 5,200 ft.

Harold Shappell 1 J. M. Bradberry, 45-2-D&W, 2 mi. SE Knox City. IPP 38 BOPD, 35-gravity, GOR 400, Tannehill 2,179 ft. TD 2,185 ft.

Montague County: Hunter Co., Inc., 1 S. D. Howard, Gaudalupe College Sur., A-286, 5½ mi. NW Montague. IP 102 BOPD, 15/64-in., 43-gravity, GOR 196, TP 90 psi., Atoka conglomerate 5,956-6,061 ft., 5,966-6,064 ft. TD 6,306 ft.

Wise County Greenbrier Oil Co. 1 Hartsell, Blk. 9, Margaret Swift Sur., A-739, 2 mi. NE Bridgeport. IP 112 BOPD, ¼-in., 40-gravity, GOR 271, TP 140 psi., Strawn 3,793-3,802 ft. TD 5,150 ft.

Phillips Petroleum Co. 1 Raney, A. B. Gibson Sur., A-994, 6 mi. N Decatur. IP 5,500 M.c.f. gas, TP 400 psi., conglomerate 6,088-6,103, 6,237-55, 6,354-72, 6,470-84 ft. TD 6,820 ft.

Amour Properties 1 Carmack, Blk. 26, Young CSL Sur., 3 mi. NW Murray. IP 236 BOPD, 10/64-in., 44-gravity, GOR 620, TP 400 psi., Mississippian 4,432-40 ft. TD 4,505 ft.

SOUTHWEST TEXAS

Hidalgo County: Shell Oil Co. 2 Boston-Texas Land Trust, Section 20, Los Guajes Segundo Flores Sur. IP 6,600 M.c.f. daily, open-flow potential, GLR 14.8 M.c.f. per bbl., 55.8°, perforations 11,756-11,826 ft. and 11,866-11,902 ft. (lower Vicksburg). TD 12,126 ft. (New pay in Javalina field).

Jim Wells County: The Texas Co. 1 Talley-NCT-1, D. Watson Sur., A-521. IP 8,800 M.c.f. daily, open flow, GLR 63.1 cu. ft. per bbl., 64°, perforations 5,123-33 ft. TD 6,215 ft. (New pay in Palito Blanco field.)

Starr County: Wood Brothers & N. T. Langham 1 Groos, Porcion 82, Share 103. IP 3,600 M.c.f. daily, open flow, perforations 1,239-45 ft. (Frio). TD 1,493 ft. (New gas reservoir in old Wood gas area.)

Sun Oil Co. 18 Mateo Saenz-State, Santos Hazan Sur. 80. IP 1,900 M.c.f. daily, open flow, perforations 7,473-7,502 ft. (Vicksburg). TD 8,552 ft. (New pay in North Rincon field.)

Sun Oil Co. 2-C Julia M. de Garza, Share 7, Los Retaches Grant. IP 22.11 BOPD, 1.4-in., 41.8°, GOR 7,417 cu. ft. per bbl., perforations 6,363-69 ft. (Frio). TD 7,500 ft. (New pay in North Sun field.)

Wood Brothers & N. T. Langham 1 D. G. Wood, Sr., Tract 14, Porcion 84. Shut-in gas well, no gage, perforations 1,418-24 ft. (Frio). TD 2,685 ft. (New field.)

SASKATCHEWAN

Royalite 6-10 Mellerdale, LSD 6, 10-33-21w3. TD 2,535 ft. Indicated oil well (Viking & Banff.)

CALIFORNIA

Kern County: Shell Oil Co. 53-14 KCL, SW NE 14-29s-26e, 76 BOPD, 30.5° gravity, 1.2 per cent cut, 20/64-in. choke, perfs. 6,892-6,910 ft. TD 10,029 ft. (New pool discovery ½ mile NE of nearest Rosedale field producer.)

Fresno County: L. A. Harnish, Operator, No. 53-34F Allison, SW NE 34-20s-16e, 1,000 BOPD, 30° gravity, perf. 10,235-10,338 ft. TD 10,358 ft. (Deeper pool discovery in center of Guijarral Hills field).

Riverside County: Atlantic Oil Co. 1 Atlantic Aros, SW SE 18-3s-7w, 50 BOPD, 23° gravity, 4 per cent cut, perfs. 3,600-3,800 ft. TD 3,853 ft. (Northwesterly extension ¼ mile northwest of Lyle Garner's new field discovery near Prado Dam).

COLORADO

La Plata County: General Petroleum Corp. F-11-32 Cater, C NW NW 32-34n-12w. IP 15,780 M.c.f. of gas per day, Paradox discovery, new field. TD 9,921 ft. Madison.

MICHIGAN

Newaygo County: Central Michigan Oil Co. 1 Arendsen et al, SW NE SW 16-13n-14w. IPP 15 BOD, Traverse lime 2,283 ft., TD 2,286 ft. (New pool.)

PENNSYLVANIA

Westmoreland County, Ligonier Township: See & Eberly 2 John E. Beck, elevation 2,845 ft., 6,700,000 cu. ft. gas, natural. Onondaga 7,433 ft., chert 7,454 ft., gas 7,466 ft. TD 7,536 ft.

Mount Pleasant Township: Peoples Natural Gas Co. 4105 Benedictine Society, 6,852,000 cu. ft. gas after fracture, Tully 6,856 ft., Onondaga 7,272 ft., chert 7,288 ft. with gas, Oriskany sand 7,427 ft. TD 7,465 ft.

SOUTHEAST NEW MEXICO

Lea County: Ohio Oil Co. 1 Ohio Oil-Cities Service "SB," 16-16s-34e, 3 mi. E Seaman field. IP 295 BOPD, 28/64-in., 37°, perforated 10,372-82 ft. TD 10,818 ft.

Shell Oil Co. 1 Kimberlin, 22-19s-35e, 11 mi. W Monument. JPP 116 BO in 21 hr., cut 7 per cent water and sediment, pay 4,659-67 ft. TD 5,483 ft.

UTAH

San Juan County: Continental Oil Co. 1 Navajo "H," C SW SE 21-40s-25e. IPF 192 BOPD, ¾-in. choke, Paradox-Penn. discovery, new field. TD 7,637 ft. Mississippian.

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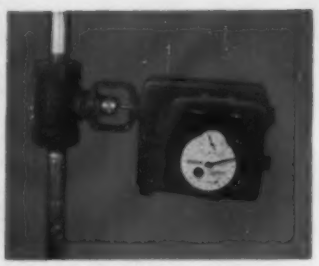
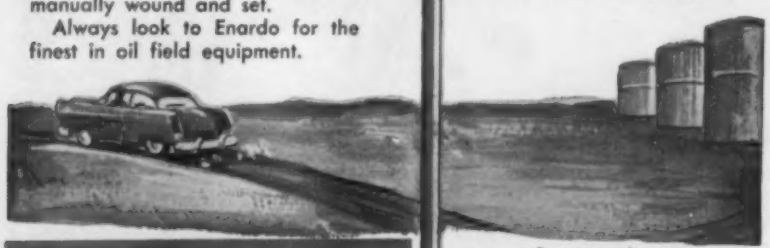


"W" Clock Shut-Off Valve



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When the chips are down and there's likely to be trouble, most operators insist on SPANG Extreme Line Casing. When well conditions dictate that only the finest casing can be used, SPANG Extreme Line again gets the nod. Naturally, a long history of exceptional performance in every type of well has built such a reputation for this SPANG product.

Two major ingredients are responsible: The SPANG Extreme Line Casing Joint *and* the extremely accurate manufacturing processes used to produce this casing. The design of the joint means that it is easy to run and re-run repeatedly—it is 100% leak-resistant and has high joint strength—it is streamlined for maximum running efficiency and clearance—it has a minimum number of threaded connections.

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NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

New Socal refining chief:

Powell Takes Over Top Spot

WHEN the directors of Standard Oil Co. of California, Western Operations, Inc., recently named Fred Powell vice president and director, they gave the top manufacturing job to a man who has devoted most of his adult life to petroleum processing.

Powell's career spans 3 decades of close association with the magic hydrocarbons of petroleum. He has built them up and broken them down, charted their courses through pipelines, and forecast the demand for their services. Western Operations has now placed him in a position where all his knowledge and experience will best serve the company.

Powell, who was born in Portland, Ore., 57 years ago, graduated as a chemical engineer from the University of Washington in Seattle. But he didn't go immediately into the oil business. He spent 3 years with Aluminum Co. of America at East St. Louis.

But the West Coast was Powell's first love. So Powell brought his family to San Francisco in 1925 and took a job as a mechanic's helper in Standard of California's Richmond refinery.

At first he dealt mainly with engineering in Richmond, El Segundo, Bakersfield, and El Paso, Tex. He didn't actually get into operations until 1936 when he became the "first planning refiner" at Richmond. In the years that followed he became president of California Refining Co. at Perth Amboy, N. J., general manager of Standard's El Segundo refinery, president of California Research & Development Co. and general manager of Standard's manufacturing department. When Western Operations was formed late in 1956, Powell's department was made a part of the new company.

Powell will continue to manage all of Western Operations' manufacturing in the West. When he has the time he'll also do something about his desire to travel on ships. He and his wife are planning a Panama vacation this summer. On the way they'll stop in Pasadena where their daughter lives with her husband and three children.

"Just being at home in Diablo is a vacation, too," he says. The Powell's attractive home, just east of the Oakland hills, is the center for his extensive woodwork and garden activities. The latest project is a bedroom set for his granddaughter.

"I'll complete it," he says, "when I've settled down to this new job."

FRED POWELL
... big things lie ahead.

Powell isn't sure when that will be. Big things lie ahead for Western Operations and Powell will be busy on the biggest refining job in the West.

C. E. Rodelander has been promoted by Tennessee Gas Transmission Co. from petroleum engineer to district engineer and transferred from Oklahoma City to Casper, Wyo.

Robert L. Kidd, president of Cities Service Oil Co., has been elected a director of First National Bank & Trust Co. of Tulsa. Kidd has been with Cities Service and its subsidiaries for 30 years, and has been president since 1956.

Norman W. Martison has been appointed exploration manager for Colorado Oil & Gas, Ltd., in Calgary. Martison was formerly division exploration manager for Shell Oil Co. in Regina.

Latham L. Brundred, Jr., has been promoted to assistant manager of the Climax-Brundred water-flood division of Climax Molybdenum Co. **M. L.** Hagan has been appointed division superintendent in charge of field operations and **Joseph C. Vaughn** has been named Nowata, Okla., district superintendent in addition to his position as district engineer. Also in the Nowata district, **Wendell P. Reich** has been named district foreman. The changes are the result of expanded water-flood activity by Climax Molybdenum.

W. L. Durr has been transferred by Continental Oil Co. to Canton, Miss., from Casper, Wyo., as a geologist.

C. R. Gerling, Shell Oil Co. junior exploitation engineer in Houston, has been transferred to Hobbs, N. M., as exploitation engineer.

Robert S. McDaniel has returned to the Chicago office of Standard Oil Co. (Ind.) as supervisor of light-oils planning. He had been on special assignment.

George A. Khoury, Jr., production engineer with Union Producing Co. in Houma, La., has joined Frankfort Oil Co. in Opelousas, La., in the same capacity.

A. A. Diamond has been named superintendent of the drilling-tools department of Magnolia Petroleum Co.'s West Texas division at Midland. He succeeds **Richard D. Myers** who had retired. Diamond had previously served as Myers' assistant for 3 years.

H. C. Slider, associated professor of petroleum engineering at Ohio State University, has been named a consultant to Humble Oil & Refining Co.'s reservoir engineering school. Slider was head of Shell Oil Co.'s Illinois division reservoir engineering section in Centralia, Ill., before joining the Ohio State faculty in 1956.

Harold Vagtborg, Jr., has joined Slick Secondary Recovery Corp. in San Antonio as petroleum reservoir engineer. Vagtborg recently resigned from the National Bank of Commerce in San Antonio where he was petroleum evaluation engineer in the oil-loan department. Before that time he was with Pure Oil Co.

L. R. Seaman, Intex Oil Co., has been reelected president of the San Joaquin Valley Oil Producers Association. Other officers are **E. C. Reid,** Gene Reid Drilling, Inc., reelected first vice president, and **Joseph M. Thomas,** Bakersfield independent, newly elected second vice president. **Charles O. Premo** was reelected secretary. **Louis A. Miller,** Miller & York Oil Operations; **Glenn C. Ferguson,** Ferguson & Bosworth; **Morton D'Evelyn,** M J M & M Oil Co.; and **W. E. Bush,** Berry Oil Co., have been elected directors of the association. **W. T. Woodward,** independent producer of Taft, Calif., has been elected to fill the unexpired term of **J. B. Spellacy,** Taft, on the board.

Personals

E. W. McNEALY

E. W. McNealy, superintendent of The Texas Co.'s Lockport, Ill., refinery, has been appointed assistant general superintendent of the Port Arthur, Tex., refinery. **H. A. Lord,** superintendent of Texaco's Lawrenceville, Ill., refinery, will transfer to Lockport to succeed McNealy. Lord will be succeeded as Lawrenceville superintendent by **Ray Powell,** superintendent, special assignments, in New York.

Arthur B. Kent, special assistant to Sun Oil Co.'s superintendent of refining, has been appointed chief chemist at the company's Marcus Hook, Pa., refinery. He succeeds **George E. Reese,** who has retired. Kent joined Sun in 1937.

C. J. Helmers, manager of hydrocarbon conversion in Phillips Petroleum Co.'s research and development department, has been appointed assistant manager of the process development division. **W. N. Axe,** senior section chief, will succeed Helmers as manager of hydrocarbon conversion.

Richard Steinhorst, Jr., British-American Oil Producing Co.'s field superintendent in the Colorado-Nebraska fields with headquarters in Sterling, Colo., has been transferred to Lafayette, La., as field superintendent. **G. H. Walkup,** field superintendent at Riverton, Wyo., will move to Sterling to replace Steinhorst as Pilot Butte field superintendent. **Paul A. Kindsvater,** assistant to the general production superintendent in Dallas, will succeed Walkup.

E. N. Little, Sinclair Pipe Line Co.'s Houston district superintendent, has been promoted to assistant Texas division manager and transferred to Fort Worth. **J. R. Ligon** has been named assistant chief general engineer at Independence, Kans., for Sinclair. **R. J. Eubank,** assistant district superintendent of the Houston district, has been appointed acting district superintendent, and **J. B. Gossett** will succeed Eubank as acting assistant superintendent of the district. In other appointments **H. V. Watkins** becomes assistant district superintendent in Wichita Falls, Tex., and **E. I. Leabo** will be assistant chief general engineer in Independence. **R. H. Meyer** has been named project engineer at Independence.

James A. Haertlein, formerly chief geologist with Nortex Oil & Gas Corp., has joined **William J. Carey,** Dallas independent, as geologist.

Harold S. Bell, formerly with Frederick Snare Corp. of New York, has opened an office in Newark, N. J., as a consulting engineer.

D. Glenn Morgan, who recently retired as director of research and development for D-X Sunray Oil Co., has joined Western Petroleum Refiners Association as a consulting technologist.

L. A. Bullington has been named technical specialist at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **R. A. Dreselly, A. R. Dudley,** and **R. F. Pfennig** have been appointed section heads in the refinery's technical service division.

Paul H. Brandenstein, drilling superintendent for E. F. Moran, Inc., has been promoted to eastern division manager and transferred to Evansville, Ind., from Tulsa. He succeeds **F. D. Harmon,** who has retired.

J. W. Mackey has been appointed superintendent of operations and maintenance in the pipeline department of British American Oil Co., Ltd. Mackey was construction superintendent of Canadian Gulf Pipe Line Co. when Canadian Gulf and its subsidiaries were bought by British American last year.

Clyde A. Brooke, Jr., has been promoted by Pan American Petroleum Corp. from district geologist in New Orleans to district exploration superintendent there. **Kenneth D. Soule** will replace Brooke as district geologist. **Aubrey D. Campbell,** district landman in New Orleans, has been named assistant district exploration superintendent.

J. N. Payne, staff geologist in Sohio Petroleum Co.'s Gulf Coast division, Houston, has been appointed division geologist. **R. J. Field,** Houston district geologist, has been promoted to Houston district exploration superintendent and **T. C. Danie,** staff assistant, has moved up to replace Field as district geologist.

C. O. Hopper has been promoted by Pan American Petroleum Corp. from district superintendent of the Canadian division's Alberta district to division drilling superintendent. **W. M. Jones,** field superintendent of the Pembina area, has moved up to Alberta district superintendent replacing Hopper. **W. M. Bogert,** production foreman at Pembina, has been named to succeed Jones as Pembina area superintendent.

R. G. Follis, chairman of Standard Oil Co. of California, has been elected chairman of Trans-Arabian Pipe Line Co. Follis succeeds **Clyde A. Swigart,** who recently retired as Tapline's chairman and chief executive officer. **John Noble,** Tapline president, has taken over duties as chief executive officer. Noble will continue to live in Beirut,

R. G. FOLLIS

JOHN NOBLE

Lebanon, Tapline's headquarters. The pipeline is owned by Standard of California, Standard Oil Co. (N. J.), The Texas Co., and Socony Mobil Oil Co., Inc.

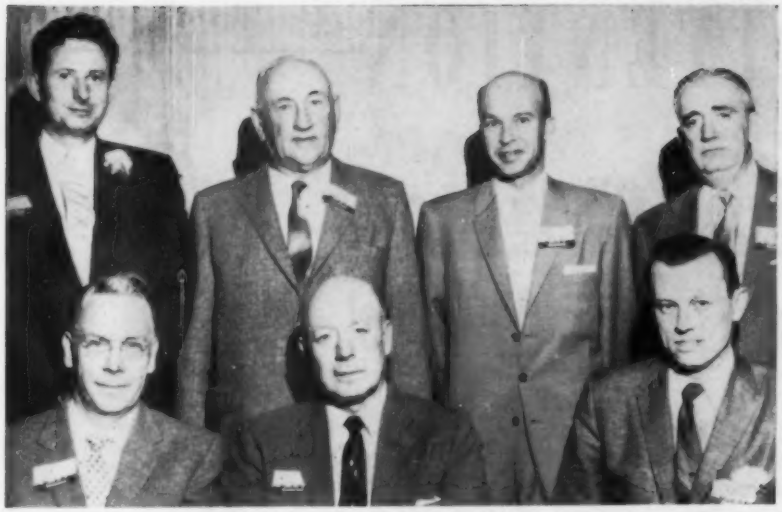
Sam H. Casey has been elected a vice president of Commonwealth Oil Refining Co. He was formerly general manager of supply and transportation for American Oil Co.

E. N. Henderson, chief engineer of Arkansas Louisiana Gas Co., **B. E. Harrell,** manager of gas supply, and **Don W. Weir,** assistant to the president, have been elected vice presidents of the company.

Joe N. Gifford has been promoted by Sinclair Oil & Gas Co. from junior geologist to intermediate geologist and transferred from Wichita to the offshore division, New Orleans. Gifford has been with Sinclair since 1955.

Jack Isberg, Superior Oil Co.'s chief geologist, Pacific division, has been named vice president in charge of exploration for the division. **N. W. Engel,** assistant to the chief geologist, will succeed Isberg. Engel was Denver district geologist before transferring to the Pacific division earlier this year.

J. P. Nolley has been promoted by Humble Oil & Refining Co. from assistant district superintendent at Florey, Tex., in northern Andrews County to district superintendent at McCamey, Tex. **E. L. Walling** was promoted from district petroleum engineer at McCamey to succeed Nolley at Florey. **Homer McCarty,** former district superintendent at McCamey, has been transferred to Hobbs, N. M., in the same capacity. **M. M. Rogers,** former district superintendent at Hobbs, was moved to Wink, Tex., in the same capacity, replacing **Delma Baucum,** who resigned.



A. F. Barrett Elected R.M.O.G.A. President

New officers of the Rocky Mountain Oil and Gas Association were named at the group's recent annual meeting. A. F. Barrett, front row, second from left, of Mobil Producing Co., Billings, Mont., is president. Others are, front row, left to right, W. H. Curry, Casper independent, outgoing president; Barrett; Bruce Anderson, Casper independent, treasurer. Second row, left to right, H. A. True, Jr., True Drilling Co., Casper, vice president for Wyoming; T. L. Dougan, Equity Oil Co., Salt Lake City, vice president for Utah; Warren Hancock, Mule Creek Oil Co., Billings, vice president for Montana; and Frank Gower, Denver independent, vice president, Colorado. Not pictured is Bob McMillen, Ohio Oil Co., Sidney, Neb., vice president for Nebraska.

A. F. Childers, Jr., who recently resigned as president of Toklan Oil Corp., has been elected a vice president of Gulf Coast Leaseholds, Inc.

M. T. Rader has resigned as district geologist in Denver for Union Oil Co. to join Creole Petroleum Co. in Caracas, Venezuela.

T. M. Babin and **D. C. Seamans** have been named senior project engineers at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **H. A. Bordelon, J. R. Samway,** and **R. H. Walton** have been appointed senior mechanical engineers and **L. D. Olafson** has been promoted to senior maintenance engineer.

C. J. Long, Pan American Petroleum Corp., is newly elected president of the Fort Worth Geophysical Society. **A. E. McKay,** Continental Geophysical Co., is immediate past president. Other officers are **O. A. Strange,** Pure Oil Co., vice president, and **D. T. McCreary,** The Texas Co., secretary-treasurer.

J. J. Wright, Jr., has been appointed Service Pipe Line Co.'s Drumright, Okla., district superintendent succeeding **Ellis Orr,** who was recently promoted to assistant Missouri-Illinois division manager. Wright was formerly West Texas division chief engineer. He joined Service in 1947.

Michael W. Huber has been elected president of J. M. Huber Corp. He succeeds **Hans W. Huber,** who has been elected chairman of the board.

Howard J. Bernard, intermediate petroleum engineer in Odessa, Tex., for Sinclair Oil & Gas Co., has been promoted to senior petroleum engineer and transferred to Hobbs, N. M.

Personals

W. A. Faubion, geologist with Continental Oil Co., has been transferred to Lake Charles, La., from Hobbs, N. M.

Charles T. Keffer has been promoted by Atlantic Refining Co. from engineer trainee to drilling engineer and transferred from Odessa, Tex., to Corpus Christi.

Robert L. Pinion, Jr., has been promoted by Humble Oil & Refining Co. from assistant division civil engineer to division civil engineer and transferred to Houston from Corpus Christi, Tex.

C. E. Davis, Kirkwood, Mo., petroleum consultant, has been elected a director and member of the executive committee of Commerce Oil Co. Davis was Shell Oil Co. vice president in charge of refining before becoming a consultant.

H. G. Boynton, E. W. Lewis, and **J. R. Miller** have been named senior research chemical engineers at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **J. R. Lander** and **W. G. Denning** have been appointed senior chemical engineers.

Myron C. (Mike) Kiess, geological manager for Sunray Mid-Continent Oil Co., has resigned to become a geological and geophysical consultant in Tulsa. Kiess was exploration manager of the old Mid-Continent Petroleum Corp. before its merger with Sunray.

DEATHS

Samuel K. C. Kopper, 42, assistant to the chairman of the board of Arabian American Oil Co., died June 4 in his home at Larchmont, N. Y. Before joining Aramco in 1953 he was deputy director of the State Department's Office of Near Eastern affairs.

Walter C. Mendenhall, 86, retired director of United States Geological Survey, died June 2 in Washington after a long illness. Mendenhall was appointed director of USGS in 1931. He retired in 1943.

Vernon Lee Whitney, 71, retired director of Standard - Vacuum Oil Co., died June 2 in Arlington, Va. He had served with the company in India for 25 years.

Joseph Olsan, owner of Olsan Petroleum Co., Dallas, died May 31 in Dallas.

Birt H. Mills, 94, retired Tulsa oil man, died June 2 in Tulsa. Mills was in the land department of the old Gypsy Oil Co., and Wilcox Oil & Gas Co. before going into business for himself around 1924.

E. R. Oberwetter, Jr., retired manager of Sinclair Refining Co.'s import-export department, died June 2 in Houston. Oberwetter was vice president of Mexican Sinclair Oil Co. before it was dissolved in 1938. He retired in 1954.

G. E. Springer, 44, Magnolia Petroleum Co. chemist in Beaumont, Tex., died June 2 in Beaumont. He had been with Magnolia since 1937.

John Joseph Shrewsbury, 63, vice president and treasurer of Hancock Oil Co., died May 26 in Long Beach, Calif.

ATTENTION

Bolivian Oil Properties Open for Public Bids!

Yacimientos Petroliferos Fiscales Bolivianos, an agency of the Bolivian Government, announces a public call for bids for a Joint Operating Contract for the development of approximately 108,000 acres of oil properties, containing three anticlines, situated directly north of the Bolivian-Argentine border.

Of the three anticlines, the Yacuiba dome (a Bolivian extension of the Argentine Madrejones anticline) may contain oil, since potential production approximating 800 barrels of oil daily, with a gas-oil ratio of some 8,500 cubic feet per barrel, has already been registered in the immediately adjacent Argentine sector.

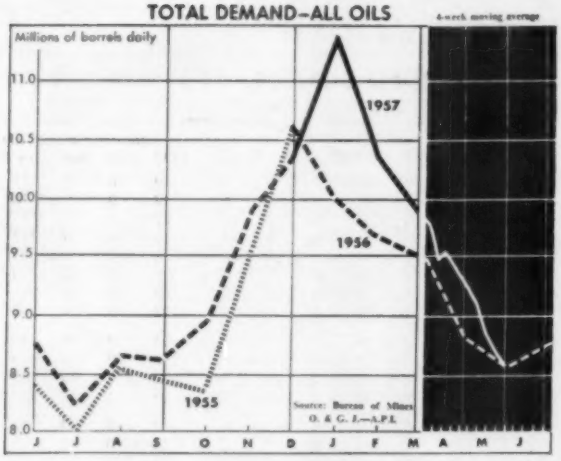
Detailed geologic information relating to the above structure may be requested by writing directly to the General Manager, Yacimientos Petroliferos Fiscales Bolivianos, in La Paz.

Interested parties may obtain official copies of the call for bids from the offices of Yacimientos Petroliferos Fiscales Bolivianos, 1026 17th Street N. W. in Washington, D. C. All bids must be received in La Paz by not later than 12 P. M., July 1, 1957.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,418,175	DOWN	11,725	UP	365,639
Crude stocks	265,461,000	UP	1,350,000	DOWN	12,675,000
Completions	921	DOWN	107	DOWN	272
Refinery runs	8,132,000	UP	222,000	UP	69,000
Gasoline stocks	195,285,000	UP	912,000	UP	10,415,000
Kerosine stocks	25,020,000	UP	1,085,000	UP	3,141,000
Distillate stocks	96,881,000	UP	5,349,000	UP	19,482,000
Residual stocks	40,067,000	UP	276,000	UP	4,231,000
Four-product stocks	357,253,000	UP	7,622,000	UP	37,269,000
Total imports	1,592,000	UP	168,300	UP	546,400



Gasoline Markets Are Soft at the Opening of the Motoring Season

GASOLINE markets are at a critical stage. If prices break further before the middle of June, they won't be back up in time to catch the peak of the major motoring season. If latest prices can be maintained until the last half of June, they have some chance of firming a little later this summer.

Another big factor in gasoline prices is the level of refinery operations in June. Many refiners have too much gasoline on hand at this time. Also, most of these suppliers hope that gasoline demand in late June, July, and August will be high enough to absorb all gasoline produced currently and to draw heavily on inventories. Stocks went up the last week of May.

If over-all refinery runs can be held down for the next few weeks, the pressure on gasoline prices will be much less. Refiners know that there will be additions to clean-product inventories during the summer months, but they don't want too much increase early in the season.

This year, gasoline stocks reached a peak on March 8 and had dropped 11,400,000 bbl. by May 25. But, for the same weeks stocks of middle distillates increased a little more than gasoline stocks went down. In the same period last year, gasoline stocks dropped about 5,000,000 bbl. more than middle-distillate stocks gained. The 1957 situation calls for further reductions in refinery runs for most of June. There will be plenty of time in July, August, and September to build distillate inventories for next winter.

In past years, some of the larger refiner-marketers in the Mid-Continent depended on purchases of gasoline to fill out supply programs during the summer months. The current outlook is for fewer purchases this summer.

Most of the spot sales of petroleum products are made either on the Gulf Coast or in the Mid-Continent. Both of these areas have surplus products that normally move to other districts. The result is that changes in supply and demand are magnified in these surplus areas.

Here is the general market picture for Group 3 and the Gulf Coast.

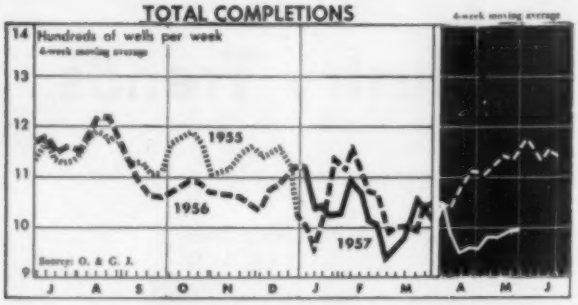
Refiners in the Mid-Continent are watching production and sales, hoping to keep away from distress selling. However, there are industry rumors that many have more gasoline in storage than was planned earlier this year. Gasoline prices were raised at the same time that octane numbers moved up. Most spot sales to jobbers are at 12.00 cents a gallon for 89-octane regular and 14.75 cents for 98-octane premium. However, the market couldn't be called firm at these prices. There is an air of uneasiness about the market. It wouldn't take more than a report of a few distress sales to set off a wave of selling that could drop gasoline prices 0.25 cent to 0.5 cent a gallon.

The Gulf Coast has passed the uneasy stage and is in a phase that could be classified as a period of dumping if there were any places to dump.

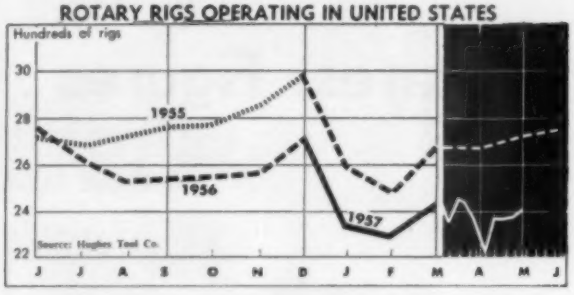
Unconfirmed reports indicate that prices received for two cargoes of gasoline for the West Coast must have been about a cent a gallon below formal Gulf Coast quotations. Other reports on conditions in the area show that gasoline is freely available and that some sales have been made at 0.75 cent under the formal quotations.

The new prices result from a continuation of the gradual softening of the market and not any sudden change.

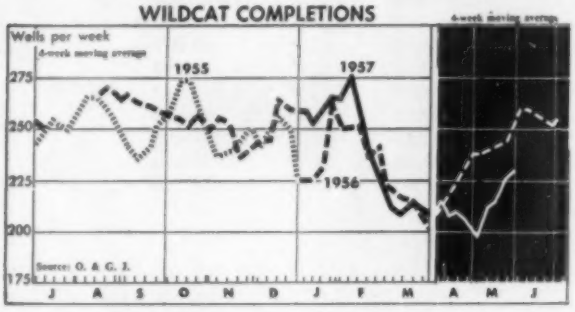
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

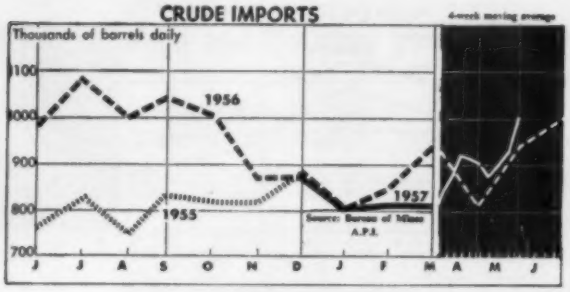
Area—	6-3-57	5-27-57	6-4-56
North Central and East	80	84	126
Southeast	43	41	29
Okla., Kans., Ark., Mo.	406	393	462
Louisiana	438	437	452
North and East Texas-Panhandle	378	365	432
Gulf and South Texas	195	211	249
West Texas-New Mexico	514	511	564
Rocky Mountain	259	248	274
Pacific Coast	98	94	120
Total United States	2,411	2,384	2,708
Canada	223	203	226

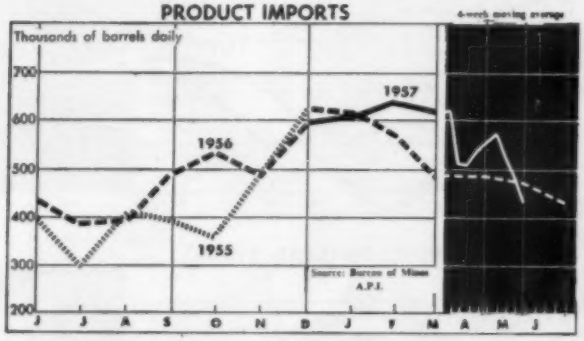
*Hughes Tool Co.

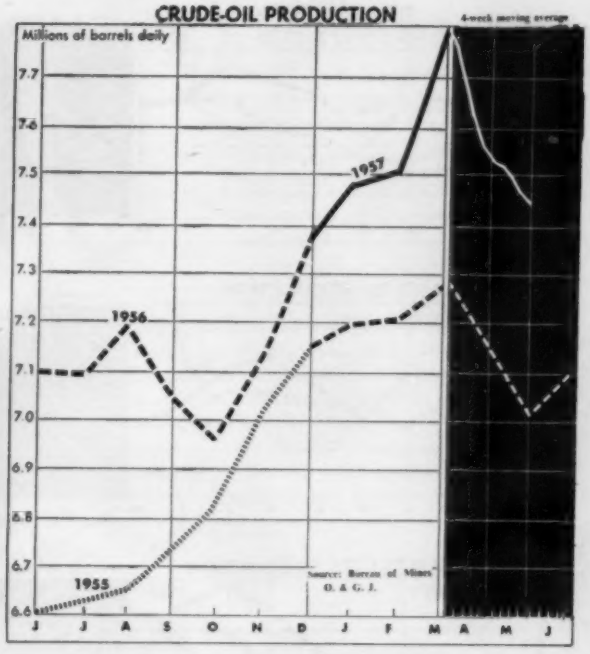
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 1, 1957

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1957				
	Comp.	Oil	Gas	Dry	Footage	1957	1956	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	†1	1	0	0	11,457	49	42	0	0	0	0	0	0	0	1	18	19
Arkansas	18	10	1	7	50,352	393	324	1	0	1	3	5	9	0	3	53	65
California	33	18	1	14	103,805	898	906	0	0	0	10	10	27	0	2	193	222
Colorado	9	2	2	5	60,118	364	495	0	0	1	3	4	13	0	9	222	244
Illinois	54	17	0	37	128,640	1,010	1,478	0	0	0	16	16	12	0	1	235	248
Indiana	19	6	1	12	33,348	266	262	1	0	0	5	6	5	0	0	49	54
Kansas	66	26	4	36	238,053	1,712	2,124	0	0	0	18	18	46	0	11	277	334
Kentucky	37	11	5	21	56,812	583	690	1	0	0	8	9	13	0	4	97	114
Louisiana	78	47	10	21	652,925	1,556	1,613	3	0	3	5	11	35	9	40	190	274
North	29	23	1	5	139,641	526	619	2	0	1	1	4	6	0	4	49	59
South	34	14	8	12	374,669	730	792	1	0	2	3	6	20	8	30	119	177
Offshore	15	10	1	4	138,615	300	202	0	0	0	1	1	9	1	6	22	38
Michigan	7	4	0	3	16,662	166	187	0	0	0	1	1	6	0	0	62	68
Mississippi	8	3	0	5	57,139	155	183	0	0	0	5	5	10	0	0	65	75
Montana	7	6	0	1	43,478	141	138	0	0	0	0	0	4	0	0	46	50
Nebraska	16	3	0	13	93,683	336	407	0	0	0	10	10	17	0	0	172	189
New Mexico	43	14	16	13	207,480	828	777	2	0	0	6	8	29	1	6	81	117
Northwest	20	3	15	2	87,891	309	292	0	0	0	0	0	12	1	5	25	43
Southeast	23	11	1	11	119,589	519	485	2	0	0	6	8	17	0	1	56	74
New York	9	4	0	‡5	9,250	195	....	0	0	0	0	0	0	0	1	0	1
North Dakota	9	5	0	4	61,464	118	102	0	0	0	3	3	5	0	0	41	46
Ohio	19	4	6	§9	48,250	428	435	0	0	0	0	0	0	0	0	3	3
Oklahoma	100	54	2	¶44	409,826	2,665	3,706	2	0	0	15	17	42	9	8	253	312
Pennsylvania	0	0	0	0	0	337	*413	0	0	0	0	0	0	0	14	19	33
Texas	358	231	19	108	1,601,733	9,148	9,243	14	3	6	61	84	273	34	92	1,972	2,371
Southwest (1 & 4)	64	38	9	17	301,744	1,127	1,353	4	1	3	12	20	38	12	26	335	411
Gulf Coast (2 & 3)	37	19	3	15	224,820	1,049	1,145	1	0	1	7	9	19	16	42	282	359
East (5 & 6)	14	8	1	5	84,390	509	474	0	0	0	2	2	4	0	2	145	151
N. Central (7-B & 9)	113	58	4	51	342,114	3,315	3,316	4	0	2	27	33	146	0	12	853	1,011
West (7-C & 8)	100	81	0	19	510,138	2,580	2,433	4	0	0	13	17	61	0	8	330	399
Panhandle (10)	30	27	2	1	138,527	568	522	1	2	0	0	3	5	6	2	27	40
Utah	3	2	0	1	19,744	73	37	1	0	0	1	2	6	0	3	33	42
West Virginia	11	2	8	1	31,156	251	286	0	0	0	0	0	0	0	7	4	11
Wyoming	16	8	2	6	56,677	340	317	0	0	0	3	3	13	0	3	99	115
Miscellaneous	0	0	0	0	0	29	57	0	0	0	0	0	0	0	1	23	24
Total U. S.	921	478	77	366	3,992,052	22,041	24,222	25	3	11	173	212	565	53	206	4,207	5,031
Total previous week	1,028	541	65	422	4,144,796	.....	.....	26	5	7	206	244	540	50	195	4,034	4,819
Total June 2, 1956	1,193	682	91	420	4,787,924	.....	.....	30	1	7	218	256	649	63	168	4,392	5,272
Cumulative 1957	22,041	11,798	1,592	8,651	91,489,041	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western Canada	62	41	2	‖19	274,403	1,044	953	0	0	2	11	13	26	0	22	234	282

Service wells included: ‡5, §6, ¶4, ‖2. *Incl. N. Y. †Ala.



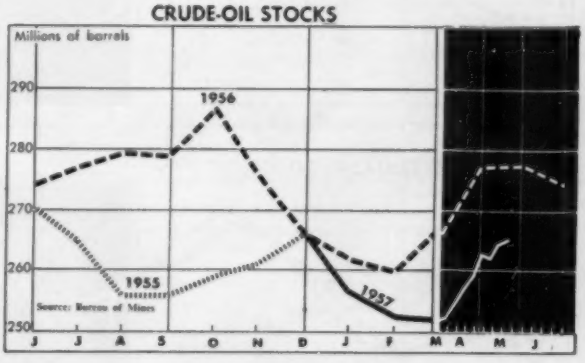



CRUDE-OIL PRODUCTION
Millions of barrels daily
4-week moving average
1957
1956
1955
Source: Bureau of Mines O. & G. J.
J J A S O N D J F M A M J

DAILY AVERAGE PRODUCTION FOR WEEK

	June 1, 1957			May 25
	Crude oil	Lease condensate	Total	total
Alabama	11,900	.....	11,900	12,000
Arkansas	85,000	300	85,300	85,500
California	928,300	.....	928,300	927,500
Colorado	155,200	.....	155,200	153,600
Eastern	51,400	.....	51,400	50,600
Florida	1,250	.....	1,250	1,250
Illinois	222,800	.....	222,800	223,300
Indiana	31,900	.....	31,900	31,700
Kansas	†331,500	.....	†331,500	†341,600
Kentucky	47,500	.....	47,500	47,100
Louisiana	853,000	73,100	926,100	926,300
North	130,500	3,100	133,600	133,800
South	722,500	70,000	792,500	792,500
Michigan	28,100	.....	28,100	28,100
Mississippi	110,650	4,375	115,025	115,025
Montana	71,450	.....	71,450	71,650
Nebraska	52,000	.....	52,000	54,125
Nevada	100	.....	100	100
New Mexico	264,550	4,600	269,150	269,250
North Dakota	37,750	.....	37,750	29,000
Oklahoma	†588,300	.....	†588,300	†607,200
Texas	3,107,000	53,800	3,160,800	3,160,800
Dist. 1	57,000	450	57,450	57,450
Dist. 2	148,000	8,350	156,350	156,350
Dist. 3	440,000	26,300	466,300	466,300
Dist. 4	231,000	6,300	237,300	237,300
Dist. 5	40,000	400	40,400	40,400
Dist. 6	136,000	6,000	142,000	142,000
East Texas Field	205,000	.....	205,000	205,000
Dist. 7-B	167,000	75	167,075	167,075
Dist. 7-C	170,000	3,800	173,800	173,800
Dist. 8	1,185,000	1,000	1,186,100	1,186,100
Dist. 9	218,000	700	218,700	218,700
Dist. 10	110,000	325	110,325	110,325
Utah	8,900	.....	8,900	11,100
Wyoming	293,350	.....	293,350	283,000
Others	‡100	.....	‡100	‡100
Total U. S.	7,282,000	136,175	7,418,175	7,429,900
Change from prev. week, down			11,725	
Canada	†545,550	.....	†545,550	†562,100
Total U. S. production—January 1-June 1			1,153,134,400 bbl.	
Same period last year (crude plus cond.)			*1,098,277,159 bbl.	

*Includes 19,569,865 bbl. condensate †Week ended previous Monday. ‡South Dakota.



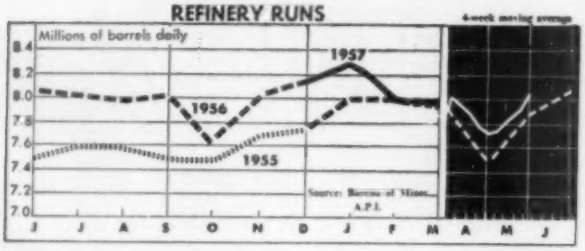
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

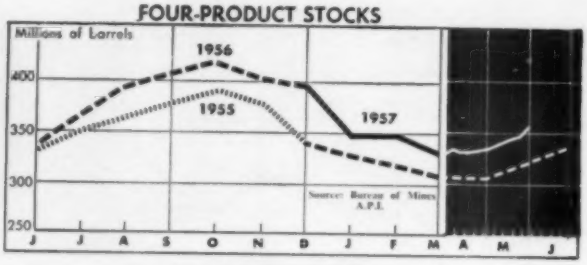
	5-25-57	5-18-57	5-26-56
Pennsylvania Grade	2,694	2,700	2,683
Other Appalachian	1,923	1,809	2,371
Illinois, Indiana, Michigan	9,096	9,658	10,801
Nebraska, North Dakota	1,675	1,803	2,348
Kansas	11,094	10,591	8,987
Oklahoma	21,262	22,467	28,196
Arkansas	2,810	2,752	3,143
Louisiana	18,851	18,366	16,343
North	2,980	2,875	2,711
South	15,871	15,491	13,632
Mississippi	2,547	2,617	2,990
New Mexico	8,304	7,756	7,693
Texas	123,335	121,816	126,008
East Texas proper	11,720	11,819	9,049
West Texas	58,502	57,681	62,248
Texas Gulf	23,011	23,241	22,701
Other Texas	30,102	29,075	32,010
Wyoming	16,832	16,936	17,629
Other Rocky Mountain	6,265	6,248	6,389
California	25,611	25,615	27,970
Foreign	†13,162	12,977	14,585
Total	265,461	264,111	278,136

*Bureau of Mines. †Includes 2,363,000 bbl. in California.

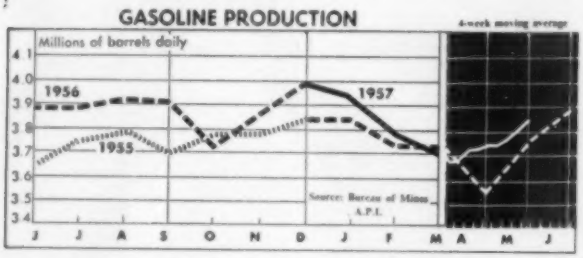
REFINERY RUNS



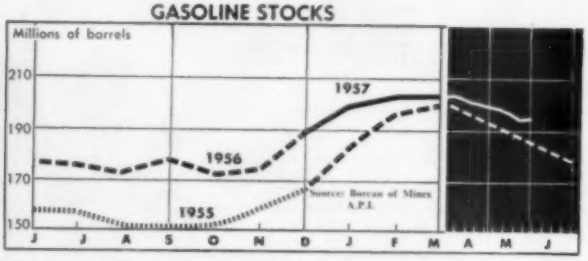
FOUR-PRODUCT STOCKS



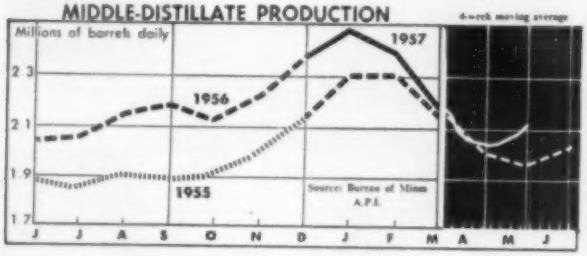
GASOLINE PRODUCTION



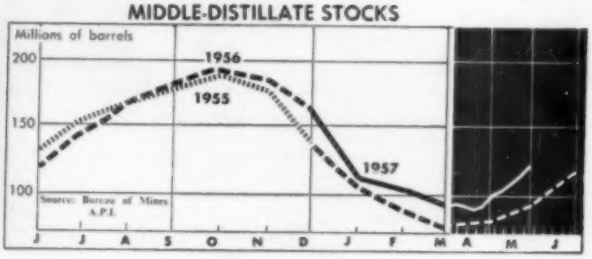
GASOLINE STOCKS



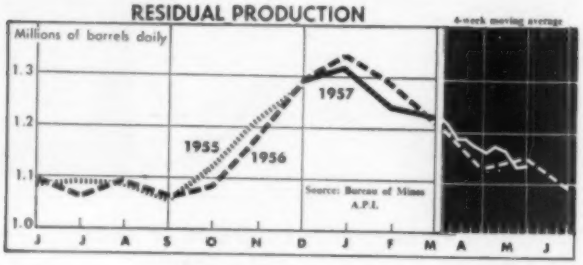
MIDDLE-DISTILLATE PRODUCTION



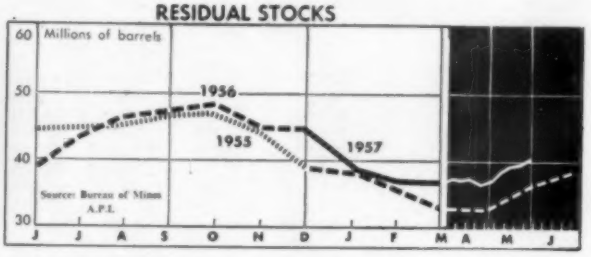
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, MAY 31, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production— Gaso.*	Kero.	Dist.	Resid.	Stocks‡— Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1956— Daily avg. runs	Daily average production— Gaso.*	Kero.	Dist.	Resid.
East Coast	1,167	506.0	39.8	306.0	201.3	43,222	10,405	32,293	9,885	1,043	417.0	27.6	239.6	196.5
Appalachian:														
District 1	97	39.0	4.0	22.1	5.1	4,853	530	2,127	474	93	35.5	3.7	22.4	4.0
District 2	91	57.1	3.4	16.1	12.2	2,696	361	832	331	106	49.7	4.0	17.2	15.0
Ind., Ill., Ky.	1,470	729.6	71.3	303.4	163.7	34,960	4,476	15,101	5,343	1,359	678.3	70.7	253.8	167.4
Minn., Wis., Dak.	105	50.3	7.6	29.6	10.7	6,567	653	4,222	395	79	36.7	5.0	22.4	5.8
Okla., Kans., Mo.	701	380.3	17.6	164.6	23.7	18,272	1,299	8,375	938	704	377.9	18.9	151.1	30.1
Inland Texas	272	194.8	7.7	55.2	20.9	7,701	340	1,997	1,745	280	199.0	8.4	52.6	24.0
Texas Gulf Coast	1,980	928.0	84.6	486.0	233.4	26,427	3,203	11,083	5,062	2,019	939.9	98.1	480.4	262.3
La. Gulf Coast	704	360.7	50.1	201.3	54.0	10,868	2,562	5,696	1,317	710	362.9	38.5	169.9	52.0
N. La. and Ark.	84	34.6	4.3	20.3	3.7	4,164	630	1,682	66	97	30.1	5.3	24.2	6.1
Rocky Mountain:														
New Mexico	28	14.0	0.6	5.1	3.7	422	9	91	66	22	11.6	0.4	4.1	3.2
Other Rocky Mtn.	255	130.0	1.3	63.6	30.7	7,448	223	2,485	1,142	270	121.5	3.8	63.4	32.7
California	1,178	500.7	10.4	191.7	380.2	27,685	329	10,897	13,303	1,114	496.0	7.8	165.5	349.6
May 31, 1957	8,132	3,925.1	302.7	1,865.0	1,143.3	195,285	25,020	96,881	40,067	7,896	3,756.1	292.2	1,666.6	1,148.7
May 24, 1957	7,910	3,871.7	268.3	1,798.9	1,083.4	194,373	23,935	91,532	39,791	.....	.....	.....	.....	.....
June 1, 1956	8,072	3,888.3	282.6	1,797.1	1,188.4	184,870	21,879	77,399	35,836	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	12.00-12.50
★ Premium (96-98 octane)	14.75-15.00
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.50-11.25
★ Regular (92 octane)	10.75-11.50
★ Premium (97 octane)	12.50-13.25
★ Premium (98 octane)	12.75-13.50
California (rack):	
★ Regular (88 octane)	13.1
★ Premium (96 octane)	15.8
Premium (98 octane)	16.2
Caribbean area (cargoes):	
Regular (87 octane)	10.875
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.0
Breckenridge:	
Grade 26-70	3.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.375
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.375
Gulf Coast (cargoes):	
★ Kerosine 41-43	9.625-10.50
★ Distillate No. 2	9.50-10.00
New York Harbor (barges):	
Kerosine 41-43	11.75
Distillate No. 2	11.15
Diesel fuel, 48-52 d.i.	11.45
Caribbean area (cargoes):	
Distillate No. 2	9.75-10.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.25-2.35
Gulf Coast (cargoes):	
Bunker C fuel	$2.75-3.00
New York Harbor (barges):	
Bunker C fuel	$3.10
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67				
15-15.9	2.71				$1.89
16-16.9	2.74				1.94
17-17.9	2.78				1.99
18-18.9	2.82				2.04
19-19.9	2.85				2.09
20-20.9	2.89	$2.75		$2.62	2.14
21-21.9	2.93	2.77		2.64	2.19
22-22.9	2.97	2.79		2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95		2.82	2.63
31-31.9	3.38	2.97		2.84	2.67
32-32.9	3.44	2.99		2.86	2.71
33-33.9	3.50	3.01		2.88	2.75
34-34.9	3.56	3.03		2.90	2.79
35-35.9	3.61	3.05		2.92	2.83
36-36.9	3.65	3.07		2.94	2.87
37-37.9	3.68	3.09		2.96	2.89
38-38.9		3.11		2.98	2.91
39-39.9		3.13		3.00	2.93
40 and up		3.15		3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low Cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, January 16, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.88
Middle District	4.70
Southwest Pennsylvania	4.41
West Virginia	4.23
Buckeye Grade	4.23
Zanesville Grade	3.27
Illinois Basin	**3.15**
Canada:	
Leduc-Woodbend	2.78
Redwater (Alta.)	2.67
Smiley (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 40°-40.9°, Puerto La Cruz	3.37
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
★ Arabian, 36.0°-36.9°, Ras Tanura	$1.97-2.14
Iranian, 34.0°-34.9°	1.91-2.04
Iranian, 34.0°-34.9°, Abadan	1.86-1.99
Iraq, 36.0°-36.9°, Fao	1.87-2.00
Kuwait, 31.0°-31.9°	1.72-1.85
Qatar, 39.0°-39.9°, Umm Said	2.06-2.19
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC—20%)	$2.28
★ N.W.I.-U.S.N.H., dirty (USMC—37.5%)	1.69
★ Gulf-U.K., dirty (USMC—35%)	4.97
★ P.G.-France, dirty (Scale—12.5%) (47s. 4d.)	6.63
★ P.G.-Japan, dirty (USMC—35%)	5.85

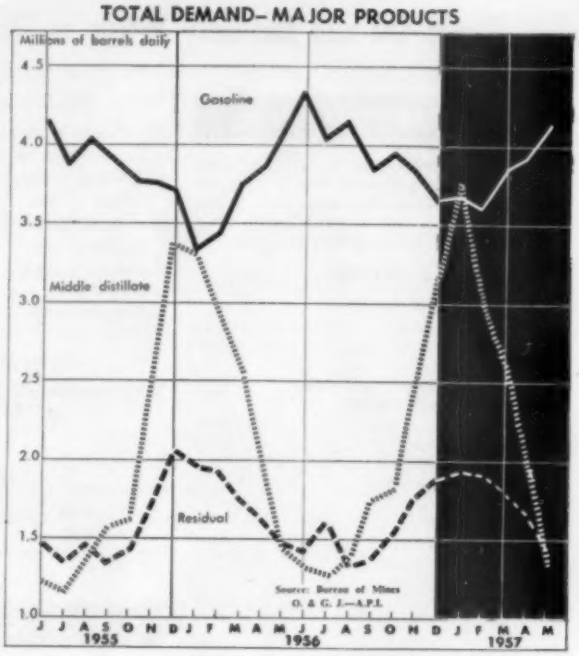
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

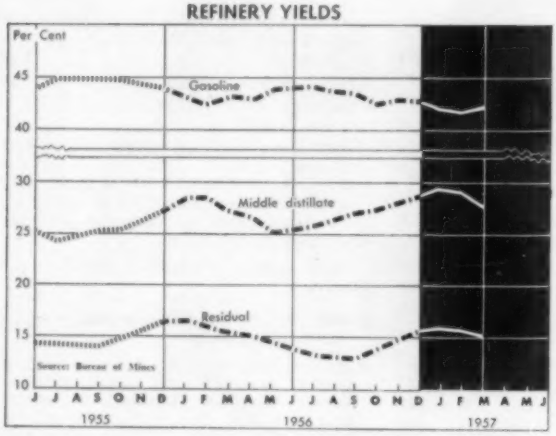
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
May 1957*	4,160	3,840	195,290
April 1957*	3,990	3,740	198,870
March 1957	3,783	3,743	106,716
June 1956	4,327	3,880	177,076
May 1956	4,093	3,756	186,673
KEROSINE			
May 1957*	147	285	25,000
April 1957*	250	283	20,880
March 1957	363	332	20,223
June 1956	153	290	26,111
May 1956	179	292	21,883
DISTILLATE			
May 1957*	1,220	1,830	96,880
April 1957*	1,710	1,760	77,900
March 1957	2,182	1,861	76,245
June 1956	1,180	1,755	93,758
May 1956	1,286	1,667	75,928
RESIDUAL			
May 1957*	1,460	1,135	40,070
April 1957*	1,675	1,163	37,350
March 1957	1,748	1,205	37,371
June 1956	1,412	1,098	39,073
May 1956	1,478	1,149	36,607

*Preliminary. †Thousands of barrels.

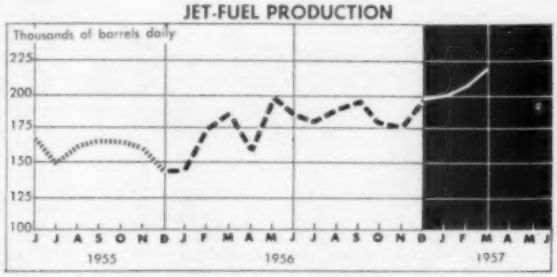
TOTAL DEMAND—MAJOR PRODUCTS



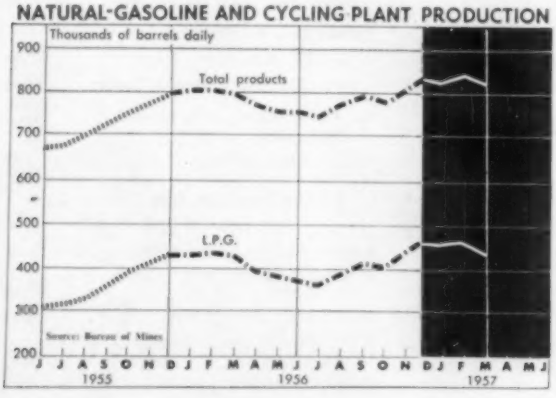
REFINERY YIELDS



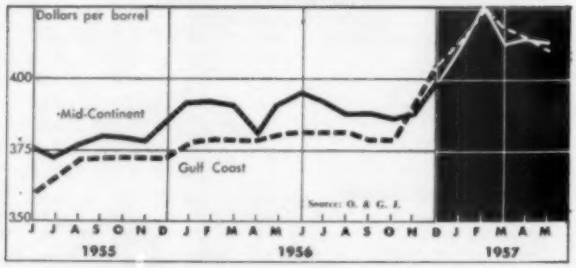
JET-FUEL PRODUCTION



NATURAL-GASOLINE AND CYCLING PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	May* 1957	April* 1957	March 1957	May 1956
Mid-Continent	$4.13	$4.15	$4.14	$3.91
Gulf Coast	4.10	4.15	4.19	3.80

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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LINE PIPE FOR SALE—New electric weld and continuous buttweld—plain ends—double random—available in July in Illinois—4½" O.D., .156" and .188" wall—3½" O.D., .148" and .216" wall. Reply Box K-209, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE EQUIPMENT

FOR SALE: Late Model Cardwell Double Drum Spudders, Ser. #RL-666 and RL-701, complete with large inventory of tools and equipment (extra good). General Tool & Supply Co., Box 4387, Oklahoma City, Okla.

FOR SALE EQUIPMENT

ONE INGERSOLL-RAND 6XVG Gas Engine Compressor, complete. C. J. Smith, Oil Capital Bldg., Tulsa, Okla.

C-34 WALKER-NEER Spudder, with or without 5-7 tools. A-1 condition. Fully equipped. Located at Drumright, Oklahoma. Box 788 or phone 20, Drumright.

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Mayhew 1000 drilling rig, water truck, and pickup. Rig mounted on L190 International, air or water, automatic pull-down. Good tires, excellent condition, ready to go.

Call 8313 or 4721,
Lovington, New Mexico.

FOR SALE
COMPRESSOR CYLINDERS

Clark Bros.: 3¼" to 11", 21", 28" and 30" x 14" VTH

Ingersoll-Rand: 4½", 5½", 6", 8", 9", 9¼", 10", 11½", 13" x 12" XVG; 5¼", 7½", 9", 12⅛", 14½" x 14" and 12" x 15" KVG

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GAS COMPRESSORS 25-800 H.P.

- 375 hp. Cooper-Bessemer GMX-6 new warranty.
- 800 hp. Worthington in operation. Too large for present job. Owner will sacrifice.
- 100 hp. Worthington "packaged unit" with 145 GXU Waukesha, skid mtd. drives & coolers, large cylinder selection. 11" stroke.
- 150 hp. Worthington "packaged", H-2000 Le Roi, skid mounted, drives & coolers, 13" stroke, wide cylinder selection — new warranty.
- Two ea. 7 x 3½ x 7 tankem CP with jacket water & gas coolers—skid mounted with engines. Approx. 35 hp.
- 10 x 10 Ingersoll, skid mounted—50 hp.
- 50 hp., 5½ x 5½, 2 cyl. vert. Gardner Denver. New.
- New Carson "packaged units" Worthington compressor, Le Roi engine to fit your requirements.

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- 160 CFM Worthington air compressor powered by Hercules engine.
- 60 CFM Le Roi compressor with paving breaker, mall point, chisels, and tamper pad. Hose & fittings. New warranty.

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LIQUIDATION 11,000 BBL. REFINERY
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We are now liquidating this modern refinery and can offer equipment at a fraction of its cost.

INCLUDED ARE: 6 Heaters with Chrome Tubes, Welded Towers from 2' to 8' with Operating Pressures up to 475 psi., Reboilers, Accumulators, Heat Exchangers, Hot Oil Pumps, Centrifugal and Steam Pumps, Boilers, Gas and Diesel Generator Sets, New Chrome Heater Tubes, Pipe, Valves, etc.

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BRILL BUYS—THE BEST!
NEAR LONGVIEW, TEXAS
FORMER LACY REFINERY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
1—5' x 96' tower. 40 tray. 135# WP.
1—3' x 50' tower. 34 trays.
1—Ethyl lead plant
2—Upshot heaters, 10 mil. BTU/hr.
8—Welded storage tanks, 5,000, 2,000 bbl.
8—Hi-vol pumps. 10 x 7 x 18, 10 x 8 x 13, 6 x 4 x 12, 6 x 3 x 8.

IN STOCK

VESSELS

2—12' x 45' Storage Tanks, 25#
1—14' x 21' Clay Tower, 125#
1—8' x 75' Tower, 20 Trays, 25#
1—18" x 32' Tower, 15 Trays, 160#
2—8½' x 23' Tanks 80#
5—Packed Towers 14" x 40', 18" x 23', 160# Wyatt 1950.
1—Poly Reactor, 550#, 24" x 28'.

HOT-OIL PUMPS

3 Pacific ITB. 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific SVTB. 612 gpm—600' hd, 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—387' hd.
1 Pacific HVTB (unused) 1270 GPM—400' Hd.
BJ hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.

HEAT EXCHANGERS

4—Kellogg Adm. Fltg. Hd. 2200, 1380 Sq. Ft., 315#
4—Kellogg Stal Flng. Hed. 800, 630, 380 Sq. Ft.
18—GR Fin Tubes, 73 Sq. Ft.
6—Brown flntube exchangers, 300# 140 Sq. Ft. 4-6 chrome.
3—Steel 1,000, 900, 800, 600, 500 Sq. Ft.
6—Adm. 785, 742, 425 Sq. Ft.
30—304 SS shell & tube condensers 100-1000 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

MISCELLANEOUS

8—Bird Centrifugals 33 x 50, 34 x 36, 18 x 28
5—Sweetland Filters No. 12, No. 10, No. 7, No. 5
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8
2—Lab Petro-Chem Furnaces ½, ¾ Mil BTU/hr.
Tremendous selection stainless steel and steel valves 1½"-8".
Goulds 16" pump, 10,500 gpm, 135' hd.

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MODERN 15,000 BBL./DAY REFINERY

HOUDRIFLOW CATALYTIC CRACKING UNIT, 8,000 BBL./DAY (NEW 1952)

VACUUM CRUDE DISTILLATION UNIT, 15,000 BBL./DAY (NEW 1953)

(2) Hot Oil Pumps—Pacific 8 Stage Centrifugal SS Lined Type ITB 2½" 334 GPM @ 1000 psi 750° F. 312 BHP

REBOILERS

993 Sq. Ft. 600# shell and tube
970 Sq. Ft. 250# shell 125# tubes

CONDENSERS—HEAT EXCHANGERS

Sq. Ft.	Shell		Tubes	
3100	steel	150#	steel	200#
1400	"	75#	12 pass	125 (2)
1080	"	250#	Admir.	125
940	"	125#	"	150 3 pass
760	"	125#	steel	125
331	"	250#	Admir.	250 (7)
331	"	250#	"	125 (3)

NEW FURNACE & CONDENSER TUBES

Quan.	O.D.	Wall	Length	Metal
6	6.625"	x ¼" x	32'0"	Croloy 5
14	5.500"	x ¼" x	32'0"	" 5
38	5.500"	x ⅛" x	20'0"	" 2
95	4.000"	x ⅜" x	24'8"	" 5
63	3.000"	x ¼" x	15'0"	" 7
110	1.000"	x 11ga. x	10'10"	Steel
475	.750"	x 13ga. x	15'11"	"
417	.625"	x 14ga. x	10'10"	Admiralty
175	.625"	x 14ga. x	6'8"	"

PRESSURE VESSELS

3'x23'6" x 1⅛"—600 psi (2)
10,000 bbl. Horton Spheroid 15 psi @ 450° F.

TANKS

55,000 bbl.	115' x 30'
10,000 bbl.	49' x 29'
5,000 bbl.	35' x 30'
27,000 gal.	10' x 40' Horiz.
18,000 gal.	9' x 36' x ⅜" Horiz.
15,000 gal.	9' x 30' x ½" "
12,000 gal.	8' x 30' x ⅜" "
10,000 gal.	10' x 15' x ½" Vert.

TOWERS

4' x 49'6" x ⅞"—24 trays 330 psi
8' x 5' x 85'—25 trays 250 psi
8'x34'6"x½"—10 trays
6'x36'x½"—9 trays 100 psi
4'6"x39'5"x⅜"—14 trays
5'x58'x⅜"—26 trays 50 psi

PUMPS

1500	GPM	@	100' head	50 HP
1000	"	"	40' "	15 HP
900	"	"	125' "	40 HP
800	"	"	100' "	50 HP
600	"	"	100' "	25 HP
570	"	"	516' "	125 HP
400	"	"	225' "	40 HP
350	"	"	560' "	75 HP
250	"	"	223' "	25 HP

Large quantity other Centrifugal Pumps Motor driven, Turbine and Steam—Simplex—Duplex—Hot Oil Send us your requirements

Proportioneers 3XXL
Gear Driven 6 x 10 Gardner
Gear Driven 8 x 10 Worthington

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AIR AND GAS COMPRESSORS
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CAR LOADING RACKS—(2) 28 SPOT
WATER TREATING PLANT 50,000#/Hr.
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Heat and Power Co., Inc.

TULSA OFFICE—310 Thompson Bldg., Tulsa 3, Okla., Diamond 3-4890

DRUMRIGHT OFFICE—P. O. Box 587, Drumright, Okla.

NEW YORK OFFICE—60 East 42 St., New York 17, N. Y., Phone 569

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Schedules 40 thru 140
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Thickness ⅜" thru 1¼"

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A clean D7 Caterpillar tractor, series 4T with an inside hydraulic 8' blade and a D7N Hyster worm driven winch. Serial #19131.

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HENSON DRILLING COMPANY

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Mail: Apartado 3963
N. VanMiddlesworth
Phone: 54 48 02

BUSINESS OPPORTUNITIES

FINANCIAL CONTACTS. Underwriters, Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 817 51st St., Brooklyn, N. Y.

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SMALL OIL COMPANY will do financing shortly through firm underwriting of its common stock. Interested in acquiring additional production through merger or stock or cash consideration. Reply to Box K-206, The Oil and Gas Journal, Tulsa, Oklahoma.

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The products are especially developed for removal and prevention of Scale, Paraffin, and Corrosion in Water and Crude Oil Well and Piping Systems on leases and in plants.

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An executive of this firm will be in your locality soon. Write now giving qualifications and details. You will be contacted after receipt of your letter regarding visit at near future date.

BOX K-205,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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Approx. 20 acres level land, steel fence enclosed, with two heavy mill-type steel buildings erected thereon — Combined area approx. 40,000 sq. ft. Unlimited sweet water available near location—First class highways to all oilfield areas and ports. Electric power available, natural gas soon. Suitable for heavy industry, warehousing, oil company base, etc.

BOX K-219,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

ESTABLISHED INDEPENDENT oil company has immediate opening for graduate engineer with one or two years of experience in oil producing operations, to be located in Midland, Texas. Write giving full particulars regarding personal history and work experience. Box K-191, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—ENGINEERS

We are interested in employing Mechanical or Petroleum Engineers, preferably with a practical oil field background, including rotary or workover rig experience. Men in their twenties preferred; must be under age of 35.

Baker Oil Tools, Inc.

P. O. Box 3048 Houston 1, Texas

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to head up engineering department for established drilling and producing company with rigs operating on land and offshore in Louisiana. Must have experience with offshore drilling barges, their construction and maintenance. Reply

Box K-203,

The Oil and Gas Journal, Tulsa, Oklahoma.

giving history of experience and other pertinent data.

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CALTEX has openings for Junior and Senior engineers to perform staff and service functions in the following fields:

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CALIFORNIA TEXAS OIL COMPANY, LTD.

380 MADISON AVENUE

NEW YORK 17, NEW YORK

c/o Personnel Dept.

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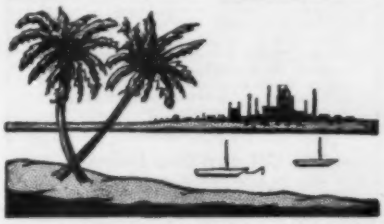
FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.



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Mud Engineer
Diesel Rig Mechanic

Overseas U. S. Drilling Contractor has opening in North Africa-Mediterranean area for a qualified Mud Engineer, also a Diesel Rig Mechanic. Two year contract, single status, vacation and bonus allowance. Good opportunity. Send complete details of qualifications, personal data, and last ten years' employment. Replies confidential.

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Experienced drilling man. Able to run casing and perform all phases of oil or gas well completion work. Act as Company representative on contract rig. Offshore and onshore work. Attractive starting salary.

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Man capable of performing same work as Development Foreman—but with Engineering training and/or degree. Salary commensurate with qualifications of applicant.

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Major independent with high growth potential is seeking petroleum engineers with up to five years experience for employment in its production department.

The starting salary for this callenging opportunity will be commensurate with your experience.

Please furnish complete details in regard to qualifications and experience, including salary required. If applicants are now employed, replies will be kept confidential.

Box K-208,

The Oil and Gas Journal,

Tulsa, Oklahoma.

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FOR

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Engineers that have recent qualifying experience in economic studies or design for construction of oil or gas transmission lines will be given immediate confidential consideration.

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Opening for graduate engineer. Experienced in oil pipe line, Pump Station & Terminal design.

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DALLAS 20, TEXAS

Phone: FLeetwood 7-1789

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INDEPENDENT OIL OPERATOR desires position with opportunity in substantial company. Experience in all phases of oil business, including promotion, drilling, production and accounting. Box K-186, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—10 years chiefly on Louisiana and Texas Gulf Coast with major, M.S. degree, young, family man, been district geologist several years with large staff, extensive background in Gulf Coast exploration, development, and drilling deal evaluation, can handle engineering aspects of development, desire permanent location in Houston with aggressive independent, lease and drilling group, or small company, might consider Lafayette or New Orleans, widely known and in good standing with excellent references. Box K-197, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST-MATHEMATICIAN: Twelve years seismic experience Mid-Continent and Rocky Mountain areas. Mathematics a hobby. Have programmed for IBM 650 Computer. Interpretation, research; domestic or foreign. W. R. Doll, 1464 S. Benton Street, Denver 14, Colorado.

EVALUATION-Landman-Supervisory: Ten years varied experience, evaluating drilling and production deals, supervision of drilling program, and land acquisition, management level. Age 37. Will relocate. Excellent references. C. R. Vandervoort, P. O. Box 1062, Midland, Tex.

LANDMAN—32, B.S. Degree, married. Six years training and experience with Major as Landman in South Louisiana. Wishes to become affiliated with aggressive independent in Louisiana or planning to locate in Louisiana. Have very good contacts with other majors and independents. Box K-204, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM REFINERY ENGINEER with broad experience with major oil company in design, construction, economic studies, equipment selection and specifications desires position with refining or petrochemical company. Box K-217, The Oil and Gas Journal, Tulsa, Oklahoma.

PET. ENGR., 34, married, six years oilfield experience in drilling, production, reservoir and workovers. Sober, conscientious, capable, employed. Desire work in Rocky Mtn. area affording opportunity to establish permanent residence. Box K-218, The Oil and Gas Journal, Tulsa, Oklahoma.

MANUFACTURER'S REPRESENTATIVE: Want to associate with manufacturer's representative who has good lines and desires to expand into Gulf States area. Reply Box K-220, The Oil and Gas Journal, Tulsa, Oklahoma.

REGISTERED PETROLEUM ENGINEER: Six years major, five years independent and consulting firm experience. Desires worthwhile opportunity, preferably in Dallas. Resume available. Box K-221, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: Age 30, veteran, B.S. degree in geology. Five years experience in Rocky Mountain area and Canada. Some Gulf Coast experience. Desires position with small company or independent. Box K-222, The Oil and Gas Journal, Tulsa, Oklahoma.

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Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

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HIGHEST PRICE PAID for oil and gas income royalties, overrides, oil properties. A. S. Berry, 520 Wright Bldg., Tulsa, Oklahoma.

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80 acres under Murphy Wells, Poplar Field, Roosevelt County, Montana. 30 acres participating. 50 acres unproven. All in same block. Present income $2000.00 per year. Will sell for $500.00 per acre.

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640 ACRE producing lease, Strahn Pool, Nemaha County, Kansas. Will farmout lease and equipment. R. D. Swan, 818 Kennedy Building, Tulsa 3, Oklahoma.

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OIL & GAS LEASES AND WELLS, Perry & Jackson Townships, Ashland County, Ohio, (Berea-Water Flood Areas). James Mason Lease: 7 Berea Wells, all pumping. 43 acres. Room for 20 more wells. Willys pumping motor with central power pumping 7 wells. 1—100 bbl. tank, 1—50 bbl. tank, other equipment. Martha Bonnell Lease: 2 Berea Wells, all pumping. 40 acres. Individual gasoline pumping units. 1—100 bbl. tank and other equipment. The above leases contain approximately 5,000' of 2" line pipe, 4,000' of 2" tubing, 4,500' of 7" Casing, 720' of 8" Drive and 6,000' of ⅝" rods. Send reply to: Charles M. Ditch, Chippewa Lake, Ohio. Ph. 3441.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 115 Littlefield Building, Austin 15, Texas.

SIX POSSIBLE PAYS TO 800 feet in Breckenridge County, Kentucky. Have 300 Acre lease short distance from newest 5 to 50 bbl. wells. Will sell outright or keep half and drill test well. Box K-212, The Oil and Gas Journal, Tulsa, Oklahoma.

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INTERESTED IN TRADING

producing 250 acre lease near Bartlesville, favorable for water-flooding, for appropriate bonus and override, or other producing royalty.

Box K-211, The Oil and Gas Journal, Tulsa, Oklahoma.

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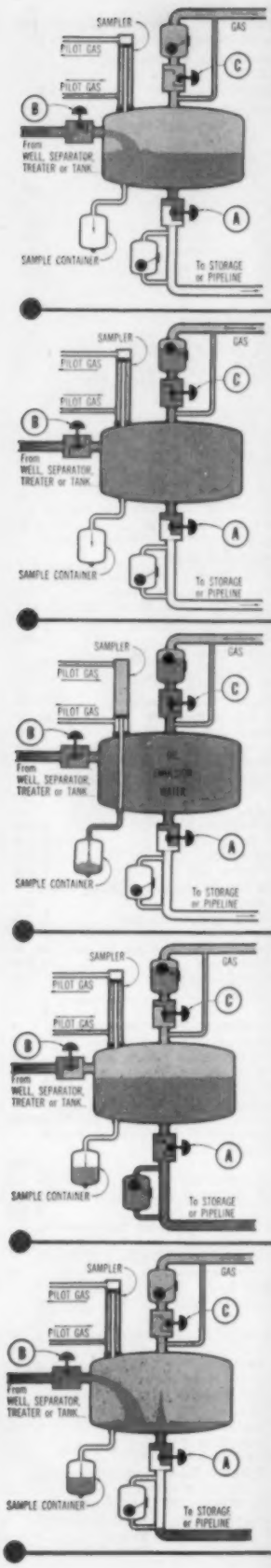

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- **FILLING** — Valve **A** is closed to retain liquid in metering chamber. Valve **B** is open to admit liquid and Valve **C** is open. The Sample Barrel is up out of the stream.
- **POSITIVE VOLUME ISOLATION** — Valve **A** is still closed; meter fills past Valve **C** which closes. Valve **B** closes, assuring meter to be full of liquid. Note the volume trapped by Valves **A**, **B** and **C** is positive and not affected by float control levels.
- **CORE BARREL SAMPLING OF LIQUID** — Valves **A**, **B** and **C** are closed. Sample tube is driven vertically through the liquid, assuring a representative, proportional sample of the entire content as it exists in the vessel. Sample is discharged to a container for future analysis. Sampler is retracted.
- **DISCHARGING AND RECORDING** — Valve **A** now opens permitting vessel to empty the positive volume. The cycle counter is actuated. Valves **B** and **C** are still closed.
- **VALVES REPOSITION** — Valve **A** closes; Valve **C** is opened, dropping fluid into meter for measurement with next volume and Valve **B** opens for new cycle.

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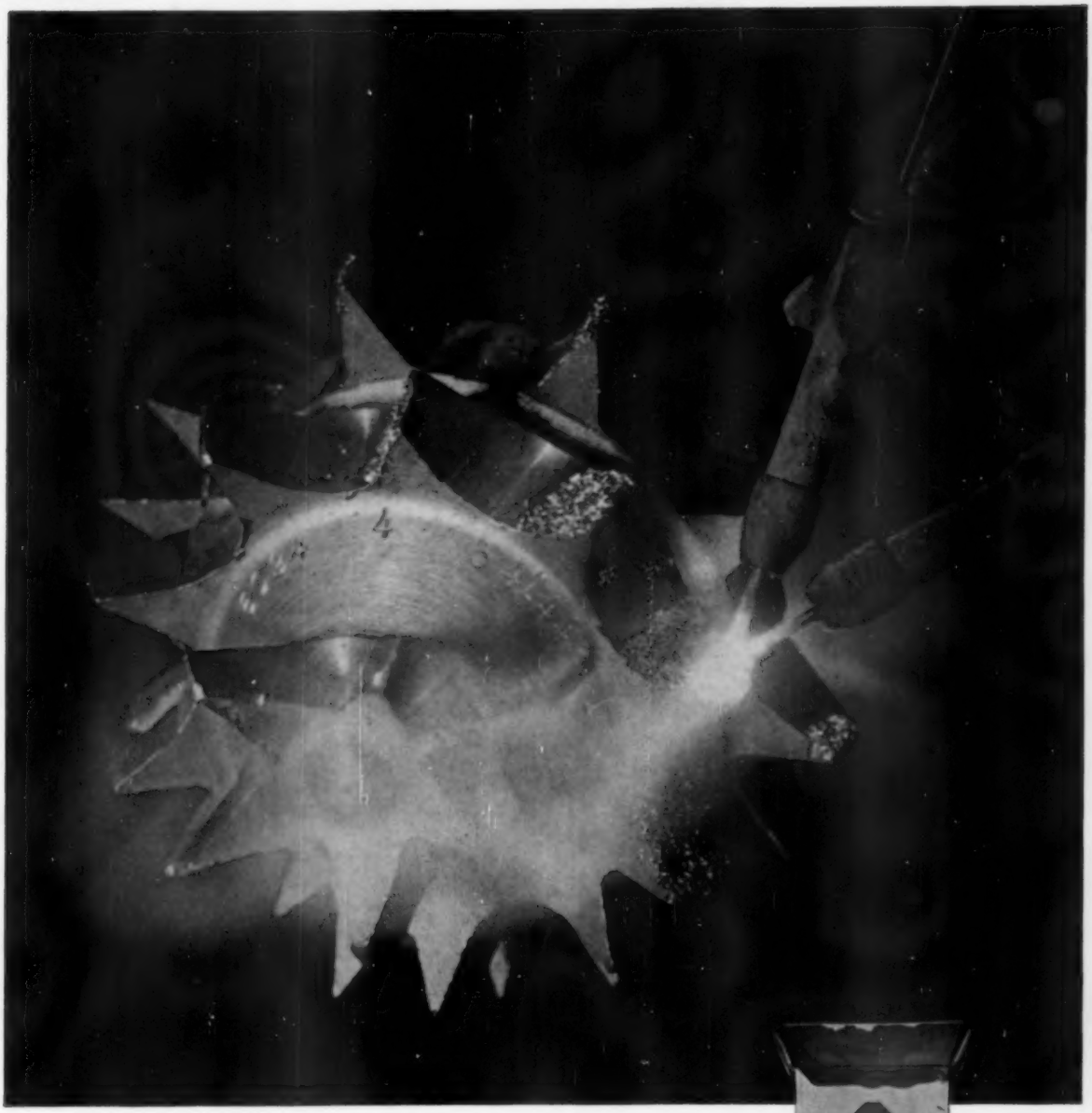

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